

December 14, 1959

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## AVIATION CALENDAR

(Continued from page 5)

- on Institute of Electrical Engineers, University of Pennsylvania.
- Feb. 16-18**—First National Symposium on Nondestructive Testing of Aircraft and Missile Components, Hilton Hotel, San Antonio Tex. Sponsors: Southwest Section Society for Nondestructive Testing, Southwest Research Institute.
- Mar. 9-11**—Conference on the Mechanical Properties of Engineering Composites, North Carolina State College, Raleigh N.C. Sponsors: North Carolina State College School of Engineering Office of Research, Research, U.S. Army.
- Mar. 18-19**—National Flight Propulsion Meeting, (closed), Institute of the Aeronautical Sciences, Cleveland, Ohio.
- Mar. 21-25**—Symposium on Optical Spectroscopy, Symposium of High Temperature, University of Chicago, Chicago Ill. Sponsors: University of Chicago Applied Science Laboratories, Inteltek Co., National Science Foundation.
- Apr. 4-6**—International Design of Space Vehicles Conference, Baltimore Hotel, Santa Barbara Calif. Sponsors: American Rocket Society's Structures and Materials Committee.
- Apr. 6-8-1968** National Meeting, Hypotheses—Space Probes, Institute of Environmental Sciences, Baltimore Hotel, Los Angeles Calif.
- Apr. 19-21**—International Symposium on Active Networks and Feedback Systems Engineering Society Bldg., New York N.Y. Sponsors: Polytechnic Institute of Brooklyn Department of Defense Research Agency Institute of Radio Engineers.
- Apr. 26-27**—National Symposium on Mixed Space Systems Institute of the Aeronautical Sciences, Ambassador Hotel, Los Angeles Calif. Cosponsors: National Aeronautics and Space Administration the Read Corp.
- Apr. 31-12**—Southwest Metals & Materials Conference, Metals and Materials for the Space Age, American Institute of Mining, Metallurgical and Petroleum Engineers, Ambassador Hotel, Los Angeles.
- Apr. 25-26-27**—Annual Convention and symposium, American Welding Society, Baltimore Hotel and Great Western Pl. Hotel Center, Los Angeles, Calif.
- Apr. 27-28**—National Meeting on Space Age Materials, California Chapter of the American Society for Metals, Quincey Gilman Hotel, University Club.
- May, 9-11**—1968 Symposium of the Institute of Radio Engineers, Professional Group on Microwave Theory and Tech., papers 1968 at Colorado State Univ., Fort Collins.
- May 16-18**—Second Southwestern Nuclear Conference and Engineering Associates Society For Metals, Sheraton Dallas Hotel and State Fair Park, Dallas, Tex.
- May 19-22**—1968 Electronic Components Conference, Wilshire Hotel, Washington D.C. Sponsors: Institute of Radio Engineers, Professional Group on Component Parts, American Institute of Electrical Engineers, Electronic Industries Assn., Western Electronic Manufacturers Assn.

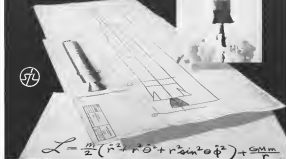
Sometimes forgotten during the thundering ascent of a space probe rocket are months of meticulous analysis, engineering and planning. The staff of Space Technology Laboratories is now engaged in a broad program of space research for the Air Force, the National Aeronautics and Space Administration and the Advanced Research Projects Agency under the direction of the Air Force Ballistic Missile Division. For space probe projects STL provides the total concept approach, including preliminary analysis, sub-system development, design, fabrication, testing, launch operations and data evaluation. The total task requires subtle original analysis in many fields as well as sound technical measurement.

The STL technical staff brings to this space research the talents which have provided system engineering and technical direction since 1955 to the Air Force Ballistic Missile Program. Major missile systems currently in this program are Atlas, Titan, Thor and Minuteman.

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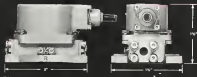


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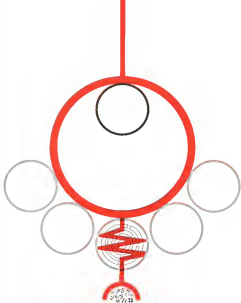
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Unique silicone rubber door seal incorporating spring steel lip support, a full size flange that eliminates the danger of seal collapse. General Electric 96-95A seal meets the strength of regular silicone vulcanized seals with steady bearing of integrally molded seal support. Over 600 spring action and pressure crilling tests prove seal will meet all operational requirements.



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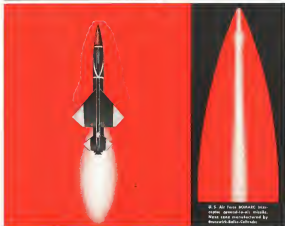


New available: New G-E Silicone Rubber Selector. This guide will help you quickly select the right silicone rubber to best meet your application requirements. In it you will find an expert class on applications, product classes, typical properties and specific cautions. Tells how to specify the grade you need by AMS, ASTM or military specifications. Write for your free copy.

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**NEEDLE CONTROL CABLE** This cable is fabricated using both braided® (in place added covering) and braided electronic conductors. Prevents vital security controlling the firing of missiles.



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**FUEL CABLE** Fully insulates electricity to fuel control valves, pump, needles and gaging devices mounted under fuel only. Portable, corrosion resistant steel bellows type conductors double layer protection between carrying connections, standard and integral connector ends.

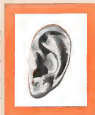


**HEAVY DUTY CABLE** Critical support cable assembly built and designed for hard work in hostile launching sites. Heavy duty braidings and a tough composite tubing resistant to most acids.



**FIBER CABLE** Six type cable constructed to look standard Nix or Bendix® pressure connectors. Advantages offered by this type of cable include: durability, performance, lightweight, plus customer space requirements.

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- Thermionic Beam Amplifiers
- Flexotrons
- Power Tetraodes

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## EDITORIAL

### Business in a Goldfish Bowl

Defense Secretary Thomas Gates, in an opening office, noted that the Pentagon was a goldfish bowl where all of its business, not screened by genuine military security considerations, should be open to public view. It is logical to assume, therefore, that all contractors doing business with the Pentagon are also conducting their operations in a goldfish bowl where eventually everything is and should be open to public scrutiny. The recent activities of the congressional investigating committee headed by Rep. Edward Hebert (D-La.) should serve as a poignant reminder to those in the military services and defense industry executives who apparently forget such considerations.

An effective relationship between the military services and the industrial complex of this country has been growing in importance with the rapid advances in technology across the entire defense front in the past 20 years. The growing requirements on both ends of this military-industrial relationship involve many thorny problems that must be solved, as most other issues in the defense program must be, in a goldfish bowl of public scrutiny and in the final analysis by the weight of public opinion expressed through the ballot box.

The defense industry, of which aviation and its related technologies have been the major component, has been engaged on wars, fronts during the past few years battling against the stranglehold of bureaucratic regulations that have squandered its profits to the bone, prevented it from financing an adequate research and development program, boosted its administrative overhead through multiple audits and reviews and boosted the costs of financing its defense role.

Dozens of congressional committees: the General Accounting Office, the Army, Navy and Air Force auditors, the Resignation Board and now the Antitrust Division of the Justice Department are busy borrowing into the defense industry's affairs. Just testifying before congressional committees has become almost a full time occupation for many industry executives and their staffs.

It is extremely important that the industry conduct a vigorous and sustained coordinated effort against any bureaucratic regulations, unjust restrictive legislation or abuse of executive privilege that prevents it from doing an effective job in discharging its technical defense responsibilities. Yet, it is extremely difficult to conduct this type of campaign and convince Congress and the law-abiding public of its ability and integrity when some elements of both the military and industry seem to regard themselves in a manner more fitting for college sophomores on a home party than responsible officials of the government and large corporations occupying positions

of public trust. The aviation industry, by its very nature, goes to in an atmosphere of close personal relationships between its key personnel and the military men who were fighting so hard to win a place for the new technology in the defense spectrum. The early days of aviation also swathed it in something of a curtain so that was perhaps not at all inappropriate for the era of public secrecy and credible facts of pushing men and structures far beyond where they really had any right to go.

Whether one clings to a nostalgia glass in fond memory or another "good ol' fashioned," these days are gone forever, and their other have little place in the modern military-industrial relationship. There are still appropriate places and occasions when this cavalier spirit of yesterday can be properly remembered by those who participate in those stirring events. But it is no longer appropriate to conduct these affairs publicly and at the taxpayers' expense.

It would appear that men with sufficient intelligence and judgment to run high military and industrial positions would be aware of that situation and, of course, many of them are. But no more than a reading of the record unfolded by the Hebert Committee or attendance at some of the semi-officially sponsored military-industry functions of the past few years provides clear evidence that this lesson has not been universally learned.

The public can hardly be blamed if they are not impressed by the sight of bearded generals swilling around Las Vegas, the gambling capital of the U. S., in white sports suits piloted by blonde chauffeurs financed by firms doing defense business. Nor can they be blamed for being overly skeptical of the "good clean face" label on the shuffling of Pentagon bills to a Roberts report and the inability of these generals to pay their own bills there. Nor does the industry, already hounded by one part of the Pentagon to drastically cut its overhead, appreciate the pressure from other portions of the Pentagon to pick up sizable tabs for large cocktail parties, dinners, equipment exhibits and other activities that can only be charged against overhead.

Unless the minority of officials in both the Pentagon and industry, who are still mentally bending people on long workdays in Cleveland, do some other thinking on the fact that Pentagon business is conducted in a goldfish bowl and behave accordingly, they will continue to jeopardize the success efforts of the majority of responsible corporate and military officials who are fighting valiantly to improve the effective working relationship between the Pentagon and industry that is so vital to an adequate defense of this country and the free world.

—Robert Hots



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## WHO'S WHERE

### In the Front Office

Wallace E. Kanda and David Bakula, directors, Epson, Inc., Cambridge, Mass. Mr. Kanda is a vice president and general manager of Epson West, a division. Mr. Bakula is president of Transvision Electronics.

Robert C. Bellows, a director, The W. L. Marston Corp., New York, N. Y. Mr. Bellows is vice president of the Contracts Division.

**Gregory H. Hartley**, a customer-lesson manager, Los Angeles Division of Service Management, Inc., Hawthorne, Calif. will accept this appointment. Mr. Hartley was president of the company's Southern subsidiary and is, currently, a director.

**Ray H. Isaac**, vice president general relations, Raynor-Archer Corp., Detroit, Mich. will be Mr. McCann's successor. Mr. Isaac is general manager of the company's Edgemoor-Powder Division, Telford, N. J. James E. Brown was named assistant

**Ralph Mosket**, a vice president of Radio Shack Corp., subsidiary of General Instrument Corp. has been named general manager of its new Advanced Development Laboratory, Worthley, N. Y. Also, **Arnold M. Wolf**, vice president, Engineering Prod. 141 Division, Bausch, N. Y., becomes D. Gerson, vice president in charge of radi-

Group Capt. E. M. T. Howell, director of an armament research and development British Ministry of Aviation, addressing Air Cadets, R. M. C. Devon.

—**Eng.** Gen. F. C. Turner, commander of the Second Marine Aircraft Wing, Cherry Point, N. C., receiving Maj. Gen. A. F. Bunker, new director of Marine Aviation.

### Honors and Elections

**Paul A. Kennedy**, vice president of Southwest Airservice, Co., has been elected president for 1968 of the Airline Distributors and Manufacturers Assn. Elected ADMAN presidents: **E. H. Fink** of B. J. Goodrich Aviation Products, and **George R. Galanos** of Van Dusen Aircraft Supplies.

**V. A. Krupp**, chairman and **Paul E. Rodgers**, vice chairman, of the Public Works Committee of the Air Transport Assn. of America, will Krupp is managing vice president-executive projects, Russell Airways. Mr. Rodgers is director of public and airway relations, Qantas Air Corp.

Dr. Hans Niquist, staff scientist in the Research & Development Division of The W. L. Mays Co., will receive the Institute of Radio Engineers' 1964 Medal of Honor for fundamental contributions to a qualitative understanding of thermal noise, data transmission and negative feedback.

The Council of the International Civil Aviation Organization has voted to bestow the first Richard Wagner Award posthumously on Dr. Albert Plesman, founder and president of KLM Royal Dutch Airlines.

(Continued on page 154)

## INDUSTRY OBSERVER

► Air Force decision is expected soon as an interceptor to fill void left by recent F-105 cancellation. Still under consideration are modified versions of the McDonnell-North 141 and the Convair F-106 fitted with new Hughes fire control system with extended range radar and the GAR-9 air-to-air missile as well as interceptor versions of the Convair F-5E and North American A-1.

India is studying four turbo-propeller helicopters for use by its air force in high altitude supply operations in the Himalayas mountain area along the Chinese border. Sikorsky Aircraft will demonstrate the S-62 this week to New Delhi. British Westland Helicopters is considered a strong contender for the job. This is in the morning with the PRS, and the French have the edge in the size of the Sikorsky, India's favourite, but the B&E Aircraft and the West German for portable co-helicopters. India regards its need, in urgent view of its border dispute with China, and speed of delivery will be an important element. U.S. sources expect a relatively small order, at least 100-150 machines from 10-15 ships.

► Fighter chosen in the second phase of the Swiss air force's re-equipment program reportedly has been narrowed to three aircraft—Swedish's Saab Draken J35, France's Dassault Mirage III and Italy's Fiat G. 91. Other aircraft seriously under consideration included the Lockheed F104 and Grumman F11F-1B (AW Oct 26, p. 103). Three-way trade group from the Swiss air force left Bern on way, to visit the Saab factory at Linköping.

USAF decision to not invest in the B-78 March 3 bomber development program (AW Dec 7, p. 26) means that the Cessna or B-58 March 2 bomber production program will be continued in Fiscal 1961 with funding for about 10 aircraft. The Fiscal 1960 B-58 program already has been cut from the original 33 aircraft program to 20, according to President Eisenhower's Fiscal 1960 budget message based that the B-78 production program would be increased this year over the Fiscal 1959 budget. Strategic Air Command has taken delivery on its first B-53 and plans to have its first complete B-58 wing in operation by mid-1960. SAC will now get a total of three B-58 wings with the strength of each wing not from the standard 45 aircraft to less than 30.

► An Force plans to evaluate the solo optical guidance system developed by Chicago Aerial Industries for possible use with its White Lance version of the Navy Bullpup tactical air-to-surface missile under development by Santa-Clorinda. Guidance system is simple, lightweight.

\*Low-cost infrared-guided air-to-air missile is being developed in Italy for possible use by the Italian air force. Missile's designation is C-7.

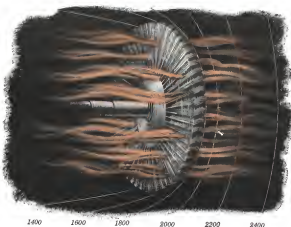
\* *Donner plane to demonstrate its single-engine all-metal Do 27 STOL aircraft during a two-month tour of the U.S. next spring. Presently the tour is now being arranged. The four-to-six-place aircraft is powered by a six-cylinder Continental or Lycoming engine developing 210 hp and 274 hp respectively. Cost, depending upon the model, runs from \$12,000 to \$17,000 (AW 5-9, p. 104).*

\* Soviet military officials claim that the mystery E66 aircraft, which recently established a world speed record by averaging 1,454 mph (AW Nov. 5, p. 30), actually attained a speed of 1,575 mph, on one of its runs. The E66, apparently a Sukhoi delta fighter, flew at an altitude of approximately 44,200 ft. during the record-breaking trial run.

► Mitsubishi hopes to manufacture the Skania 561, known as the Vord 107-2, under license in Japan. Both firms are expected to apply to the Ministry of International Trade and Industry for permission to negotiate with the U.S. firm for domestic production of the two behemoths.

► Air Force is considering leasing in England all spares for the Douglas Thor intermediate range ballistic missile not required for U.S. missile programs and Royal Air Force transport planes from Vandenberg AFB, Calif.





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## Washington Roundup

### Patents and Big Business

A report to Congress by the Justice Department expressing concern over the concentration of technological know-how in a few large corporations through military research and development contracts is behind hearings on patent policy started last week by a Senate Small Business Subcommittee on monopoly, headed by Sen Russell Long (D-La.).

In a letter to Long, noting a heavy concentration of military experimental and developmental contracts in about 35 firms, Acting Assistant Attorney General Robert Tuck of the Antitrust Division observed:

"Advantages accruing to any company performing government research are numerous. First, it gets a fee for the job. Beyond that, it gains know-how in new product development, or in the use of new raw materials and processes to manufacture existing products."

"The company performing research can further benefit from resulting patents, by obtaining a legal monopoly over the subject of its invention—the power to exclude others from the field. Moreover, companies able to hire top-notch technical research personnel financed by their own utmost resources and equipment, providing a staff for the future. During wartime the advantage of the scientific training, this is a substantial advantage. Finally, government work may give access to vital restricted data not available generally for social security reasons."

In 1947, the Justice Department urged full government ownership of all patents resulting from government contracts. Under the Eisenhower Administration, the Department so far has been unwilling to endorse such a drastic measure. Justice, in cooperation with Defense Department and other interested agencies, has a study under way and has asked Congress to withhold any legislative action until the study is completed.

Bills emphasized the effectiveness of antitrust enforcement. Compulsory licensing under a 1936 patent clause of patents that International Business Machines Corp. had issued in electronic and mechanical data processing equipment, for example, has resulted in competition by many businesses and "has aided the rapid growth of that modern industry."

### Disarmament Study Proposed

Outlook is that disarmament proposals will figure prominently at the coming session of Congress. Design Sen. Herbert Hensley (D-Minn.), chairman of the Senate Disarmament Subcommittee, has announced he will fight for a 5400-hour appropriation for a control arms disarmament study under the Senate Disarmament Subcommittee. Senate has indicated to Hensley that it will support the project. Efforts by Hensley to obtain funds for a major study this year failed, largely because the Administration failed to support the project.

### National Policy Machinery

Meanwhile, a Senate subcommittee on national policy machinery headed by Sen. Henry Jackson (D-Wash.) is studying these proposals:

- That State Department participate in the proceedings of the Joint Chiefs of Staff.
- That a JCS representative sit with the Policy Planning Staff of State Department.
- That both State Department and Defense Department

participate in decisions on national budgetary "guidelines"—now decided by the Bureau of the Budget.

Jackson expects to start hearings in January.

A staff study prepared for the subcommittee took note of criticism that "our foreign policy planners, in a group, have not concerned themselves enough either with the future political consequences of weapon systems in the laboratory state, or with non-military technical developments holding promise of great impact upon foreign policy. Similarly, it is argued that our research and development program would benefit from clearer guidelines concerning projects which might best help further our foreign policy goals."

The staff study also pointed out "The budgetary process—the delicate resource-allocation instrument—lies at the very heart of national security planning and preparing. Plans and policies, without dollar signs attached, are mere aspirations. It is the budgetary process which translates them into actual programs."

### The Gold Rush

Current official U.S. concern over the foreign payments deficit and consequent drain on U.S. gold reserves was endorsed last week by United Nations economists in the quarterly bulletin of the UN Economic Commission for Europe. The UN group and the "industry and research" shown by the United States in agreement with the purpose of the cause of the high-level U.S. foreign payments deficit—the foreign aid program initiated in help European countries recover from World War II. The gold drain has been cited by the Administration as one of the reasons for holding down federal spending.

UN economists said the United States has run an international payments deficit every year since 1948, with the exception of 1957, because of the large scale assistance provided West European and other countries to promote economic recovery and growth. "It appears surprising then, that at the moment when a considerable part of our foreign aid program has been completed, and when but disaster and concern should ease," they said.

### Continental Controversy

Attempts by Continental Airlines to introduce the supersonic jet into the Transpacific Route Case is a significant factor in its arguments for a route from the U.S. mainland to Hawaii were checked last week during hearings in Washington. After listening to Continental officials discuss the convenience of the supersonic transport, Civil Aeronautics Board Economic Welfare Division ordered all such testimony strictly focus the record on grounds that it was irrelevant and that a lengthy discussion on the subject might delay the expedited case.

However, Continental immediately injected another controversial issue which rapidly became a focal point of the arguments: a proposed three- and one-half cent per mile fare on the Hawaiian route. Continental argued that this low fare is practical and feasible on turbulent transports, since its experience with the Boeing 707-120 shows that average phase mile costs are only \$1.54 compared with \$2.06 for the DC-7B. Continental believes the target for more agreement when it announced that the breakeven load factor on its 707s is as low as 41% on a fully allocated basis.

—Washington staff







# Mercury Network Offered for Soviet Use

By Craig Lovan

Washington-National Aeronautics and Space Administration Administrator Keith Glennan offered to let the Soviet Union use the Mercury tracking network in its reconnaissance program next week, highlighting a slowly emerging trend toward broader international cooperation in space projects.

Glennan's offer came at a time when negotiations are keeping the U.S. and the Soviet Union from signing a Space Research (COSPAR) agreement that has been resolved and when the group was in the final stages of preparation for its first international space symposium next month in Nice, France.

The offer to the Russians also paralleled similar offers made to cooperate with other nations on space science projects. The U.S. is at various stages of developing cooperative projects with several countries, and a program with the United Kingdom is moving close to final agreement.

Glennan made the tracking offer to the Russians as evidence of U.S. interest in international cooperation, and the Soviet Union has been tracking support from the U.S. "when and if such nation undertakes a manned space flight program." Raw tracking data would be transmitted to the Academy of Sciences in Moscow. If the monitoring of the Soviet mission should be required, Glennan said the U.S. "would be happy to provide them or to use equipment furnished by the Soviet scientists."

## Equipment Differences

Equipment differences were cited as a possible block to such a cooperative operation by Soviet scientist A. A. Belyakov during a recent trip to the U.S., but he said it is "very desirable" to discuss such a change. Mercury net could give the Russians much more complete tracking on a manned satellite than they can get from within the borders of Government-owned countries. There are no indications the Soviet Union plans to establish a tracking network outside these countries.

Russian group led by Prof. L. I. Sidorov discussed possible cooperation with the U.S. last month during meetings with Glennan and with NASA group headed by Deputy Administrator Hugh Dryden. Since the possibilities of cooperation are generally limited by what the Russians are willing to do, they were asked just what kind of cooperation they wanted.

Soviet view was that cooperation would be useful but that any agreement should be carried out on a step-by-step

basis and that the first step should be a conference on space problems as suggested by the Soviet delegate to the United Nations Dryden told the Russians. NASA would be willing to participate if invited to such a conference. UN elements also said they were on the generalist side of the issue, which has recommended certain activities that could be undertaken within the framework of the world organization.

The concept of international cooperation was well established during the International Geophysical Year effort and, when IGY was over, COSPAR was founded under the International Council of Scientific Unions to take over and continue the cooperative effort in the space field. When the first COSPAR meeting was held a year ago, the Russians observed they had only one seat among the 48 representatives of the countries, and demanded greater representation as the price of their participation.

The profits-oriented approach to organization of a scientific group disturbed the scientists, but they set to work drawing up a compromise suggestion. Last month, Sidorov said he did not know whether the Soviet Union would be represented at the Nice meeting, but he had "impressions" that COSPAR was hoped to discuss of major scientific and technological questions and that he was afraid the impression would get "drowned."

At the time Sidorov was making these observations, a meeting had just been concluded in the North Atlantic at which a tentative agreement was reached. This new charter says the committee to use ICSU track activities engaged in space research but it also establishes a series of the Executive Council in which voting power is now controlled. The executive council is composed of representatives selected from all nations on the committee.

## Mauler Team Selected

Washington-A new assignment to select a committee to develop the Mercury air defense missile system has been given to the Mauler team. The team was led by General Electric, which led a team. Other bidders included General Electric, Martin and Sperry Inc.

The program has been made a cloud of uncertainty as to whether the Air Force would not allow such a missile to be fired without a war signal. It would be fired without a war signal. It would be fired without a war signal. It would be fired without a war signal.

plot representatives of scientific nations interested in space research, and those latter delegates are to be chosen on the basis of broad national representation.

That new approach should provide Soviet bloc nations with greater representation. Also, all observer delegates must be invited by two-thirds of the seven-member bureau. These seven members are to be selected for three-year terms in a year that will give both the East and the West a vote on decisions. This plan has been accepted by ICSU and, since the Soviet Union is a member of that group, apparently the Russians have accepted the plan and will go to the Nice meeting.

## Avoiding Duplication

Glennan told the Institute of World Affairs in Pasadena, Calif., last week that it is desirable to coordinate national space programs to avoid duplication of effort. The plan has been to use knowledge that comes from coordinated effort. He commended the ICSU space group and "we look forward to the early establishment on a more permanent basis of the Committee on Space Research to coordinate coordination of basic scientific research in the space field."

Glennan mentioned satellite tracking and data acquisition, sending radio signals, observation of the atmosphere through satellite radio signals and laboratory and theoretical research in support of space activity as examples of programs where cooperation would be most productive. "The basic steps in international cooperation in space participation in a single program with participation of scientists of two or more countries in the design of experiments and in the preparation of payloads for satellites and space probes," he said.

U.S. is currently discussing such cooperation with eight nations from the European and Pacific areas. These countries are: Australia, Canada, France, Germany, Italy, Japan, the Netherlands, and the United Kingdom. The agreement is in progress, which could form the basis of bilateral agreements for specific space science projects. This bilateral agreement shows five months from Sea Henry M. Jackson (D-Wash.) also termed the agreement, which would be a joint North Atlantic Treaty Organization effort gathered into AGARD in the aeronautical field.

Historical agreement closest to realization is with the United Kingdom. In Soviet agreement was reached earlier this year but the British in depth and build three 130 lb satellites to be put into 100 or more orbits with NASA's Scout booster by mid-1961. The agreement is expected to be made formal within



USAF to Test Air-Launched Sounding Rocket

Test program to determine feasibility of vertical air-launched sounding rockets to measure neutral ionization around the earth is being conducted by Air Research and Development Command's Special Weapons Center. Three-stage solid propellant rockets, designated Jager, are designed to track altitudes of up to 600 mi. and orbit launch from a Martin B-57.

British satellite group. Another proposal under discussion involves a Canadian plan to orbit a "synthetic satellite" satellite which would become radio signals off the ionosphere, from those far from earth with ground signals reflected from the bottom of the ionosphere.

Three satellites would be launched by U.S. bombers—perhaps, the solid propellant Scout which is estimated to cost about \$600,000 each. Even work that requires a vehicle, a satellite, present any cost as much as \$10 million when the expensive data gathering and analysis is included. Along with complete satellites, other nations are proposing artificial experiments which would be done along with planned U.S. satellites.

Basic advantage to other nations in this cooperative approach is that the U.S. can provide the booster that does it. As for the Scout, NASA director, James H. Doolittle, says that the points at which the U.S. benefits in terms of getting data from satellites NASA would not put up with all of other nations' interest in doing the job under the cooperative programs. All projects are subject to approval by the British arm. But, within a range, no funds are charged, the U.S. pays for the launching vehicle and the receiving country pays for the satellite. Scientists from these nations also are invited to work on their projects on U.S. laboratories if they wish.

Pattern for another phase of cooperation was set this month when NASA accepted a detailed report on the Project Echo satellite sphere which will be

launched next spring as a passive communications satellite (see p. 57).

A third form of cooperation on over the worldwide tracking and telemetry facilities involved in such projects as the Mercury mission. NASA says experiments with the University of Michigan, which runs the Jager launch facility in England and other groups for tracking and its telemetry data gathered. A number of tracking systems have been established by the U.S. in other countries which are not for personnel from those countries.

## Blue Water Missile Backed As NATO Arm

Beam-Defense project of Great Britain and West Germany will receive approval of Britain's Blue Water missile, which is being developed by North Atlantic Treaty Organization.

Blue Water is under development by English Electric Co., Ltd., as a replacement to the U.S. Cepheus missile. The missile is being developed by the British arm. Blue Water is a 100 mi. range missile and the missile probably will utilize solid propellant fuel.

David Watkinson and Frank Just Strum announced the joint decision following two days of meetings in Bonn. They added that if NATO agreed, the two countries would launch develop the 100 mi. range missile. The weapon will be capable of carrying a nuclear or conventional warhead, is intended to have a high degree of accuracy, and would

actually be made in about 1964. Britain observes that all such weapons would be placed in the hands of the Western European Union (WEU) for an independent nuclear strike force. Britain and Germany along with France, Italy, Belgium, Holland and Luxembourg are members.

However, the British are the only ones who currently possess a nuclear capability, and have officially expressed reluctance to share it with non-nuclear powers.

Shores and Watkinson also agreed on cooperation in missile target development. Of prime importance in this respect are working agreements by British Royal Navy's Maritime Command, Anglo-German and between British Submarine, Foreign, and Intelligence. British Navy's AG Cooperation is an anti-air defense against low-flying aircraft was also cited.

## Rocketdyne Fuel Pump

Los Angeles-A fuel pump for liquid hydrogens is being operated by Rocketdyne Division of North American Aviation Inc., in part of a joint Atomic Energy Commission-National Aeronautics and Space Administration rocket research program.

Under a company-sponsored research program, Rocketdyne also has operated hydrogen-peroxide rocket engine tests, possibly consisting of a fixed chamber and a complete liquid hydrogen fuel system, including a LOX hydrogen gas generator and turbine and controls.





**HONEY** is held in its plastic form (left) by a harness which leaves its arm free to perform tests with a lever. Master was carried in a bagpack (right) which was positioned on the animal back underwater before launching during the Little Joe tests.



**BOLDFRONT** Mercury capsule was launched (left) by a Little Joe booster with four Thoron and four Rocket solid propellant rockets. Capsule landed in the Atlantic Ocean about 22 miles, light and was picked up less than two hours after launch (right).



## Little Joe Launch Tests Mercury Capsule Escape



**NAVY** RECOVERED from upon the pressure vessel in the bolddrill Mercury capsule (left) and recovered the bagpack container: the monkey (right). The 100 lb. bagpack had a plastic shell and aluminum wire structure and the system carried a 40 lb. supply of oxygen.



Washington—Third Little Joe shot by National Aeronautics and Space Administration tested escape rocket blast effects on the Mercury capsule hatch and carried a monkey safely through the escape and recovery cycle.

Fifteen tons of the Little Joe launch from Wallops Station, Va., was a high altitude test of the escape rocket system and measurement of the pressure and temperature effects on the Mercury capsule hatch.

The flight also carried a monkey through the escape cycle under the maximum acceleration expected during an emergency escape on an actual Mercury launch with a man aboard.

### Bolddrill Capsule

This test with a bolddrill capsule was the third in a series of Little Joe launches of experimental capsule hardware. The series is scheduled to include a qualification test of the McDonnell Aircraft Corp. capsule now in production. Series three also has included tests of the booster system and of the escape system under maximum dynamic forces.

Third launch was the first in which the Little Joe booster, built by North American Aviation, Inc., used all four Thoron and four Thoron Re-

**HONEY** was rescued from bagpack by crew of USS (left) nearly seven hours after launch and showed no ill effects from the heat and weightlessness encountered.









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## Incentive Plans Promote Airline Travel

Travel plans gain potential as business firms promote mass personnel airfares as important sales tool.

By Glenn Gosselin

New York-Airlines are reaping increasing benefits from the expanding use by business firms of travel incentive plans involving air transportation, a growing segment of the group travel market that will be an important factor in filling airlines seats.

Incentive travel plans, often tied in with company sales meetings with extensive use of airfare, are developing into an important business tool not only for large firms but increasingly for smaller companies. In fact the smaller groups, which travel on scheduled flights and provide airlines with a flexible way to top off loads, are considered by many carriers to be a big potential in this field.

Large firms, however, have provided some recent spectacular examples of the use of chartered airlines to bring their dealers or salesmen closer to all over the country in a cost-effective way for business and/or pleasure. At one operation now under way at Miami by the J. I. Case Co. involves 137 flights by seven airlines and is expected to total 25 million passenger miles of travel.

### Package Costs

Case's movement of more than 3,000 dealers and distributors of its farm implements and industrial machinery began Dec. 4 and the return flights will end Jan. 11. Case won't disclose the total cost, but an airline official has estimated that the company will pay about \$3 million for the whole package, including hotel accommodations and local entertainment. Dealers are coming in from 42 states in the U. S. and Canada and one plane load is arriving from Paris.

Cole H. Marrow, executive assistant to the president of Case and coordinator of the Miami operation, says that J. I. Case West that his company's sales have increased 300% during the three years since the airline program was initiated. Case held its "World Promoters" program in Phoenix, Ariz., in 1957 and in Naples in 1958. The Phoenix meeting involved 124 airline passengers and the Naples meeting 19 rail cars.

These annual meetings, where the year's line of products is unveiled and marketing plans presented, have proved "very successful," Marrow said. They are "the most important thing we do in the company for a year," he added. Marrow stressed that the incentive is a business meeting, "not a holiday," although sales incentive features are in-

cluded in the meeting program. Dealers meeting the required sales quotas in the example, can bring along their wives, spouses, live-in girlfriends, regardless of their quota status, around the country.

This differs from some other plans which are designed only to provide on- or off-airline vacations or trips for dealers or salesmen who meet certain quota requirements.

Case follows up its yearly meetings with the distribution of films and other promotional material based on the "World Promoters" program. The meetings themselves, Marrow pointed out, could not be accomplished, except through the use of air transportation. "The airplane is being used as a tool for a definite type of business activity," he said.

The Case air operation at Miami is centered at Fort Lauderdale and 10th St. terminals at Miami International Airport, across the field from the new ter-

minal which handles regular scheduled traffic. Eastern is handling about a fifth of the work, some 35 flights on 90 passenger Douglas DC-7s each week. The Eastern terminal was set up for the project.

Case is actively raising the show doors on an operational standpoint and has set up a center in the terminal complete with help for its on-airline operations office and in Case branch distributors office in 25 U. S. and Canadian cities. In 40 Case offices in Miami to handle reservations, local transportation, and other phases of the operation.

### On-Line Plans

Of Eastern's flights, 11 will involve all-line points such as Kansas City and Toronto and the rest will originate or terminate at airline points in its system. Other airlines involved are Delta, National, Northwest, Pan American, TWA, United, and Western.

Equipment for use in the program was flown in by United cargo aircraft and United will handle about half of the passenger charters. SAS speed transportation for the Pan Am cargo line. Airline equipment chartered for the program includes Douglas DC-6Bs and DC-7s, Lockheed Super Constellation and Boeing Stratocruisers. Case insisted that all birds should be fully equipped airplanes, according to Eastern.

The special projects department of Case began its first studies for this year's meeting last July. Marrow said, and all contracts were let around Oct. 1. Contracts were let on a flight-by-flight basis.

### Altitude Timing

The mass movement is being timed to coincide with the Christmas and New Year's holidays when airline equipment will be at short supply. It does, however, come considerably close to the extreme holiday peaks. Under the plan, groups of dealers are flown on speed, day and four nights, and are flown out again to be replaced by other groups.

On the first day, Dec. 4, some 14 flights arrived, another 10 arrived that day, and 10 flights left the line around Dec. 20. These staggered movements will last Dec. 20 and return Jan. 5 to skip the two holidays. During the movement days, a plane is scheduled to arrive to depart every 15 min. First day's arrivals are flown each Saturday, Jan. 10.

San Francisco and Los Angeles, Phoenix, Houston, Atlanta, and Oklahoma City, among others.

Case describes its operation as "the largest civilian activity in history." Other examples of recent large movements of business sales groups are those of G. H. Ruffignault Co., which offers year-end vacations to dealers who satisfy quota requirements. The 1959 incentive operation by Gibson involved movement of more than 3,000 persons to and from San José, Puerto Rico, with several airlines participating with charter aircraft and scheduled space.

Another example is Fadden-Duigan Co. (air conditioning), which has given its dealers vacations in Mexico, Mexico and Europe. Largest group was 3,000 persons. The 1959 operation was divided between Argentina and Europe, with Pan American handling the transoceanic business involving 2,000 dealers (AW June 2, 1959) and Eastern, among others, handling the vacation to the New York group.

Gibson is planning a chartered jet airliner next year to Honolulu, with Pan American handling the other 31 flights from 15 U. S. cities in Boeing 707-120 equipment.

One of the firms which are going in for incentive travel to boost their sales, organizations of various kinds are making further effort to hold their annual convention. Convention business has long been a big source of airline revenue, of course, and many firms have special departments to handle it. Growing use of air transportation in convention activities has changed the geography of convention sites and the timing of their scheduling, often to save time and distance will greatly expand this trend.

Examples of this trend are the conventions of the World Retail Alliance, scheduled for Rio de Janeiro next year, and the International Textile Convention, planned in Tokyo in 1961. The Japanese are expected to have about 4,000 and will be moved by various airlines on a nonstop voyage back mostly to the U. S. and Canada.

Planned through equipment and growing, it is coming only a breath of the in-flight market for group travel. That airlines, to most airlines, are a group of passengers from about a dozen up to a chartered airplane and is variously handled in sales approach and statistical analysis. This market has been growing rapidly in the past five years or so and provides many advantages for the airlines.

Philip M. Seifert, Pan American's manager of special sales—as well as other airline officials—in the holding of off-season traffic volume. American indirect would come from providing many group customers with air travel opportunities which leads to future sales.

### Fifth Airport

New York—Port of New York Authority met last today with New York and New Jersey legislatures to discuss plans for a fifth metropolitan airport in this area under Port Authority operation. The agency reportedly has plans for a large commercial airport near Manhattan.

Governor Robert W. Fuld of New Jersey and some local officials have voiced apprehensions about the choice of the "port airport area" at New York International Airport.

Seifert said his airline's approach to large firms is to sell sales incentive, convention and industrial incentives. He said that the airlines are not going to be the mainstay of the small business groups, too, with the competition increasing greatly.

Transition to jets will affect the charter business of various airlines and the airlines are not going to be "classics for jets," Seifert said, but an airline at this point as scheduled to contract a great deal of jet equipment to the field. The average customer didn't know the difference between types of jets and the airlines are not going to make the difference between a jet and a jet.

Seifert said. Companies aware of the Gibson plan with chartered jets also want jets, Seifert said.

The Gibson movement will be Pan American's largest jet to do in an area concerned with the total air the trip over \$10 million.

American Airlines reports that practically every charter customer now wants a 747. Gibson's plan, however, has been to use less than 25% of the total. National that company is a thing to Miami 15 winners of a day closing competition. In some cases of large first, company pilots probably putting more than a certain number of first representatives in a single flight.

Another National incentive group movement involves 130 winners of a case company reward, and the airline has only 15 on its way to Europe. The airline is planning through equipment and growing, it is coming only a breath of the in-flight market for group travel. That airlines, to most airlines, are a group of passengers from about a dozen up to a chartered airplane and is variously handled in sales approach and statistical analysis. This market has been growing rapidly in the past five years or so and provides many advantages for the airlines.

Philip M. Seifert, Pan American's manager of special sales—as well as other airline officials—in the holding of off-season traffic volume. American indirect would come from providing many group customers with air travel opportunities which leads to future sales.

United, as another example, also finds its business meeting and executive traffic is growing, attracting an average of 10% first and 15% next year.









## Boeing 735 can carry cargo for 3¢ a ton-mile



Photograph of scale model of Boeing 735

The Boeing 735 cargo jet, capable of transporting freight for as low as three cents a ton mile, offers unparalleled opportunities for the development of world-wide air cargo operations.

Based on the long-range, proved-in-service Boeing 707 intercontinental, the new cargo jet will be capable of carrying 166,000 pounds of cargo across the U.S. in five hours. It will be powered by turbofan engines, providing increased take-off performance for short-field operations, as well as economy at high speed and long range. The new Boeing 735 cargo jet can be delivered in early 1982.

The wing-tail 735 is part of an advanced integrated transport-to-transport cargo system now under development by Boeing's Transport Division. The system includes ground transporters, special pallets, pre-built containers and other equipment designed to expedite loading, unloading and ground-handling operations.

Air-conditioned and pressurized cargo space totals 9,000 cubic feet. Range, with 100,000 pounds of cargo, is more than 2,000 miles. With a work rate four times that of current piston aircraft, the 735 could, in one week, carry as much cargo across the U.S. as a 40-car freight train.

**BOEING 735 CARGO JET**

## Retirement Rules Fight Planned By ALPA in Court, Congress

Washington—Air Line Pilots Association and both legal and congressional support in the union's efforts to share all a new Federal Aviation Agency regulation requiring airline pilots to retire at the age of 60 effective next Mar. 15 (AW 10/7, p. 5).

At the same time ALPA President C. N. Soren issued a strongly worded protest against other FAA regulations establishing higher cockpit qualifications, which Soren and ALPA state is a violation of original agency proposals and an "unjustified compromise." He charged that FAA had "suddenly decided to bow to the air carriers' objections to more adequate rules based largely on cost." The union also said that he intended to file the combination of statement and cockpit qualification regulations, which he said FAA has "violated the air safety point touched."

Soren and ALPA are moving "immediately" to challenge FAA's authority to issue the age ruling by seeking an injunction against the agency in the federal courts challenging both the legality of FAA administrative procedures in the action and the agency's right to exempt pilots of their "exempt rights." FAA earlier noted that a request by the union for a hearing on the regulations was not granted because questions raised by ALPA had been covered either in comments gathered on the proposed regulation or that no new information could be expected.

The pilots' union said it also will not acquiesce and to defend the manner and process in interpreting and debating of FAA powers by Congress when it retroactively next month.

While FAA's new regulation for cockpit training and qualifications have been expanded, Soren contends that they have been diluted from those originally proposed by FAA, and long sought by ALPA.

The problem of pilot flight restrictions, the pilots maintain, is not an "absolute" retirement age based upon age of flight hours submitted by FAA but the high number of regulations resulting from "transition" and US union issues, which ALPA claims can be experienced at any age. ALPA and other unions have argued that the members encompassed 3,572 such cases of stomach aches, dizziness and food poisoning over a seven-year period. Results of the survey, it contended, point to a need for a "trial test" concept of operations where pilots demand that other crew members be qualified to assume

control of the aircraft in emergency. ALPA had argued that cockpit training and qualifications be expanded to require a type rating for each aircraft being flown, proficiency checks each six months and extension of a new air-line transport cockpit license requiring at least 1,500 hr of dual and solo flight time as pilot in command of less than 12,500 lb or 750 lb on larger planes. The union also recommended that any other crew member with a competency

can license and instrument rating be allowed to assume 95% of his scheduled flight time towards a cockpit license.

ALPA contends that the new regulations adopted fail to ensure that cockpit pilots will be qualified on their respective aircraft since they are not required to acquire a type rating, as do pilots in command.

"These deficiencies," Soren said, "will leave the situation where an airline can have a pilot with 200 hr of 'CofP' time, a commercial license, and instrument rating, give him some undefined training check him out on one type of airplane, assign him to fly in a completely different type and then set short his publications for a year."

## British Bloc Integrates Operations

New York—in an apparent move to combat the competitive threat of the new Air Wales—a British bloc composed of three global airlines will be established Apr. 1 to permit integrated operations and the pooling of resources on routes between New York, London and the Far East.

The three airlines—British Overseas Airways Corp., Aer-India International and Australia's Qantas Empire Airways—will operate the bloc as a closely coordinated sales, traffic and scheduling unit for the primary purpose of increasing their share of "the world's air national traffic in the jet age." The agreement is similar to that BOMAC reached earlier this month with Trans-Canada Airlines (AW 7/7, p. 5).

Under the working arrangement, services probably will be split among the three carriers in ratio to the number of seats normally adopted under each program. Selection will be arranged in accord with each carrier's department and records of flights and present full competitive coverage of flight operations over a 24-hr period.

Possibility that the arrangement will create a strong bloc within International Air Transport Association conferences and meetings is not being overlooked by its detractors. BOMAC denied such an strength in its fight for lower fares at the London IATA traffic conference in October (AW Oct. 29, p. 28) from the five Commonwealth airlines it was over to its side.

Air-India took a strong stand in opposition to BOMAC at the IATA conference general meeting on the far side of the Atlantic. The airline said that BOMAC in the Far East routes could possibly force Air-India and other carriers competing with BOMAC to follow suit for competitive purposes. However, that does not suggest—yet—that the agreement will force Air-India to change its position on these

routes within the traffic conference. The agreement also calls for the consolidation of sales offices, unloading of tickets and joint use of ticket sales offices. It is possible that a ticket office competitive to another within the bloc will be closed. Each carrier will remain its identity but cooperation with one another will be chartered.

Both Air-India and Qantas intend to gain in the expansion of their sales efforts in the lucrative U.S. travel market because of the large number of sales offices now operated by BOMAC in this country. Air-India currently relies almost entirely on travel agents for U.S. sales and will be saving the cost of supplementing new sales facilities over when it plans to begin its New York-London route.

Since Trans-Canada operates its transatlantic route through the Montreal gateway also served by BOMAC, it was not included in the agreement signed with Air-India, which will open the east of New York, and Qantas, which serves both the New York and San Francisco gateways.

## Court Instructs CAB To Reconsider Award

Washington—U.S. Court of Appeals last week directed the Civil Aeronautics Board to reconsider its award of \$1.14 million, made to Trans World Airlines on grounds that transatlantic toll fares were agreed to on an open basis.

TWA also avoided the route in the Great Lakes region. Reconsideration was ordered in a decision on Dec. 15, 1981. The decision was requested by American Airlines. In a 20-page opinion, Chief Judge E. Barrett Brennan found that the board had limited the scope of the case, but had not taken into account several aspects when account in establishing a decision.







# AVRO 748 AVRO 748 AVRO 748 AVRO 748 AVRO 748 AVRO 748

Some aircraft operating today are severely limited in the amount of payload and/or fuel that can be carried from holes in high altitude. The low-cost Avro 748 can operate from these "critical" airstrips without restriction on useful load. Where restrictions must be applied, these are much less severe than for any other aircraft in this class. The Avro 748 takes off and lands safely on semi-prepared surfaces, and can operate with full payload from airfields of very limited runway length. At maximum take-off weight of 33,900 lbs. (14,970 kgs.), the total distance to take off and reach a height of 30 ft. (10.69 m.) is 2,420 ft. (736 m.) in International Standard Atmosphere conditions at sea level. This aircraft can also take off in 3,260 ft. on one engine.

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wherever  
there's  
an  
airstrip  
There can be an **AVRO 748**



## Airline Traffic—October, 1959

	Revenue Passengers	Revenue Passenger Miles	Load Factor %	U. S. Mail Ton-Miles	Express Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	% Increase in Available Ton-Miles
PACIFIC TRUNK								
Alaska	758,578	321,309	49 9	1,894,142	1,227,737	10,337,574	13,459,453	41 6
Boeing	188,119	82,243	28 1	574,540	179,205	8,779,345	9,533,090	48 7
Capital	107,014	156,046	87 7	347,221	233,170	465,515	1,045,906	53 7
Continental	128,329	71,022	38 9	157,189	164,256	3,118,821	3,430,266	38 6
Delta	162,130	127,850	58 8	479,085	342,209	1,423,219	1,458,703	49 7
Eastern	214,239	127,137	46 10	1,121,734	265,167	1,704,757	32,719,207	38 4
Midwest	154,085	87,434	46 7	379,769	72,901	631,721	7,353,048	38 9
Northeast	99,427	34,420	28 9	112,827	20,616	135,885	1,886,244	33 6
Northwest	156,893	114,493	59 8	1,447,150	334,025	1,202,366	12,417,167	47 5
Trans World	482,427	418,843	87 8	1,647,110	931,867	3,959,417	66,461,467	38 8
United	257,769	167,419	65 3	2,318,140	1,635,414	6,491,719	67,104,808	37 8
Western	114,124	63,223	39 6	227,957	59,711	395,534	6,468,496	33 6
INTERNATIONAL								
American	9,014	8,569	32 9	11,234	—	200,518	5,126,984	54 8
Boeing	2,773	2,747	46 6	26,076	—	113,418	959,714	42 9
Continental Atlantic	35,379	1,873	44 9	1,740	—	34,719	171,426	47 9
Delta	3,276	6,022	41 8	7,118	—	489,438	687,438	37 6
Eastern	28,904	42,443	46 47	79,660	—	372,121	4,373,492	47 38
Rocky	7,728	1,471	44 2	—	123	8,809	179,198	43 2
Trans World	5,717	9,198	71 5	10,511	243	44,432	200,464	37 7
Northwest	12,717	14,397	43 2	1,234,232	24,707	1,162,577	5,566,198	30 8
Pan American	4,002	6,221	42 6	42,763	—	165,164	446,986	44 8
Alaska	116,699	166,912	72 8	1,944,419	—	5,477,702	32,458,147	64 9
Latin America	95,487	106,284	46 8	426,643	—	2,345,949	16,479,507	61 9
Pacific	37,813	106,057	72 6	1,471,261	—	3,329,100	16,479,507	61 9
Panagra	11,833	16,318	46 8	73,272	—	426,491	3,389,194	61 6
Swire	6,347	10,222	80 7	—	—	5,117,312	3,127,303	60 6
Swire-Cathay	—	—	—	—	—	747,719	3,127,303	60 6
Trans World	30,816	29,349	39 4	691,404	—	1,376,474	6,451,086	37 3
United	8,149	10,227	42 2	144,722	2,342	9,218	5,311,541	37 3
Western	4,162	6,446	38 4	5,677	—	13,430	766,207	41 8
LOCAL SERVICE								
Allegiance	32,148	9,731	48 8	15,212	26,748	26,167	1,867,919	47 8
Boeing	30,443	3,076	44 1	6,474	2,889	8,449	393,173	66 6
Continental	12,119	2,981	36 1	7,437	6,476	11,256	1,156,167	40 6
Frontier	38,489	7,419	38 6	34,913	12,506	71,336	467,407	40 6
Lois Continental	50,177	5,476	44 7	6,212	21,497	37,242	379,427	46 6
Norfolk	24,156	19,376	33 5	12,373	14,406	9,743	1,268,198	46 6
North Central	10,335	14,072	44 27	37,319	399	20,791	1,877,293	43 1
Ozark	20,764	9,766	46 1	15,829	27,448	36,340	937,737	46 8
Pacific	44,392	19,324	46 1	18,439	4,282	20,791	1,274,526	46 8
Piedmont	42,664	9,077	46 1	15,829	14,164	18,027	951,426	46 3
Southwest	24,180	4,206	36 3	12,122	12,788	14,262	486,126	37 3
Trans World	27,282	12,318	46 1	12,318	12,476	46,200	1,179,861	37 3
West Coast	36,486	7,661	40 47	13,028	2,618	16,774	726,672	40 41
BRITISH								
Alaska	31,381	3,673	38 9	2,342	—	5,098	361,465	32 7
Boeing	35,433	5,414	34 2	7,437	—	183,406	407,761	33 9
CANADIAN								
Allegiance	—	—	—	—	—	734,440	734,440	33 4
American	—	—	—	—	—	7,773,121	10,340,243	47 6
Flying Tiger	1,147	1,593	44 2	62,115	107,847	—	—	—
Elster	—	—	—	—	—	34	32,462	—
Boeing	—	—	—	—	—	1,428,041	1,428,041	36 9
Continental	—	—	—	—	—	1,148,412	1,148,412	36 9
Eastern	—	—	—	—	—	2,877,274	2,877,274	36 9
Northwest	3,243	7,421	100 100	—	—	6,008,128	6,008,128	36 9
Rocky	—	—	—	—	—	—	—	—
HELICOPTER LINES								
Chicago Helicopters	22,243	187	46 0	1,264	—	—	28,246	45 8
Los Angeles Airways	2,479	57 9	38 2	6,879	2,420	—	12,478	34 5
New York Airways	13,616	216	22 9	1,373	8 50	—	22,162	31 9
ALASKA LINES								
Alaska Air Lines	9,706	7,282	38 9	4,227	2,971	427,383	5,286,262	40 3
Alaska Central	5,716	419	35 9	3,616	—	4,514	66,471	34 2
Continental	—	—	—	—	—	—	—	—
Delta	4,119	218	38 9	2,415	—	2,473	38,718	47 8
Frontier	7,070	473	46 8	34,026	—	86,374	162,172	39 4
Pacific Northwest	6,892	38 8	102,736	8,124	372,716	1,123,868	49 2	
Rocky Airways	—	—	—	—	—	—	—	—
Trans World	2,237	710	36 9	43,264	—	62,332	162,101	40 3

\* Not available.

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.



## Pan American, National Stock Plan Vetoed in Examiner's Proposal

Washington—Abandonment of stock exchange and option purchase plans accompanied a three-page opinion issued last week by Pan American World Airways and National Airlines (NAAW Nov. 10, 1978, p. 70) has been recommended by a Civil Accounting Board hearing evidence on a proposed deal approved of the airline would require in control of National by Pan American and in the indirect granting of a domestic route to the larger carrier.

At the same time, Examiner Leslie G. Donohue said he approved of National's plan to lease of American Airlines 707 jet equipment now in its second and final year and recommended approval of a long-term lease under which the carrier would enter into a regular lease of 707 and Douglas DC-8s equal to a 33-year period beginning next year.

Donohue, however, conditioned his approval of the long-term lease on an extensive plan that would require the airlines to divest themselves of a substantial amount of 400,000 shares of stock and the elimination of an option permitting Pan American to purchase an additional 250,000 shares of National stock. Here's how abandonment of the stock plan could be accomplished under the Donohue proposal:

- **No later than 90 days after a final CAB order in the investigation,** the carrier should return the 400,000 share blocks of stock already mutually exchanged and return the additional stock option purchase provided for National Airlines. If all or part of the option has already been exercised, National should repurchase the shares for the price at which they were sold.
- **Within the same period,** the carrier should use the proceeds to purchase the stock held by each other.
- **Any plan submitted** will be subject to the approval of the Civil Accounting Board. The plan must be in the form of a stock plan, in the form of a stock plan, in the form of a stock plan.
- **During the period prior to the actual sale of the stock,** must be held by an independent trustee who will have sole right to vote the stock with a majority of stock at stockholders' meetings of the respective airlines.
- **Plan submitted** must not permit any plan distribution of stock to the shareholders of either carrier.
- **At the same time,** the New York Stock Exchange directly to a qualified purchaser not purchasing for speculative resale or to underwriters and dealers, with a proviso that no one person or group may acquire more than 10,000 shares.

- **Stock may not be sold** to one person, firm or corporation where the carrier has an interest before purchase agreement would require prior CAB approval.
- **Any shares of National stock** required by Pan American through its purchase option must be placed with an independent trustee and then sold within one year of the date of purchase. During that period, the stock would be voted by the trustee, along with a majority of all other National stock, in the same manner as stock exchange.
- **Any agreement** between the airlines and trustee must be approved by CAB.
- **Both carriers must file a quarterly report** with the Board during the period of the stock exchange showing the number of shares of stock sold and the names and addresses of the purchasers.
- **CAB must initiate proceedings** over the proceeding as to follow up to its final order in the case.

## Hawaiian Carriers Reap Bonanza From Sightseeing Over Volcano

Hilo, Hawaii—Hawaii's two local airlines last month reaped an unexpected revenue bonanza brought about by thousands of sightseers eager for a real view of a volcanic eruption in the Hawaiian Islands. The flight to Kilauea cost \$15 a head from here.

A total of three eruptions, the longest of which lasted seven days and nights, provided both Aloha Airlines and Hawaiian Airlines with top load factors in a steady flow of 40-hour round trip excursion flights between Honolulu and the rim of the crater. The ticket price was no match for the domestic origin of the crater. In 1975 when the spectacle attracted enough passenger traffic to pull both

lines of Donohue's argument is that Pan American already has obtained direct control of National through the joint exchange of 400,000 shares of stock in December, 1978. Pan American, he said, holds about 25% of National's stock and has become its largest single shareholder. Exercise of an option, anyone would give the independent carrier a total percentage of 33%.

Donohue said, as compared with National's holdings of Pan American stock which amount to only 6%.

Noting that the exchange shares for a period of eight years be in independent trustee would have little effect on the question of control over National, Donohue said, since National officers, who are elected for a period of only one year, would be unable to oppose the decision of Pan American, the largest stockholder in the company.

Approval of the stock transaction, the examiner said, also would amount to the "abdication of an aviation long carrier" by Pan American, the first of giving a domestic route, between Boston, New York and Miami, even though the airline's past application for a domestic route has been repeatedly denied by the Board.

Donohue said of the deal for that year. Nevertheless, last month's volcanic spectacle seemed to set new No. 1 traffic record in both carriers' recent history. The flight to Kilauea cost \$15 a head from here.

During the month, Aloha carried a total of 38,170 passengers as compared with 33,000 in the month of last year—1978's season. Hawaiian loaded 45,999 passengers in the same period as compared with 29,007 passengers in November of last year.

Both carriers said their most spectacular gain during the last campaign which lasted a full week. During the week, Hawaiian carried 10,651 passengers for total revenues of \$157,590 as compared with the 7,557 passengers carried last week. Hawaiian carried 10,651 passengers for total revenues of \$157,590 as compared with the 7,557 passengers carried last week.

Alaska operated the first flight over Kilauea on Nov. 14 when it left Hilo at 8:02 p.m. and returned at 8:02 p.m. on Nov. 14. The flight was the first of three 44-passenger Fairchild F-27 turboprop transports left Honolulu at 11 p.m. each, the volcano and returned at 1:30 p.m. Hawaiian was the first to exploit the volcano's revenue potential. First com-

mercial flight took off from Honolulu at 12:30 a.m. and by 2:30 a.m. the carrier had sent three 52-passenger Can-Can flights to cruise the rim. Despite the late hour and the short season, Hawaiian's Honolulu terminal, located on the opposite of the field from the main terminal, was packed with prospective passengers.

During the following seven days, both carriers conducted vigorous advertising and promotional campaign to maintain the heavy traffic flow. Hawaiian pitched a large net over its loading gate to accommodate arriving crowds. Passengers waiting for flights were given a preview of their trip in the first-class cabin of the carrier.

Here's how the two airlines operated during Kilauea's 1978's season:

- **Hawaiian Airlines** made 51 excursion flights from Honolulu around the volcano and back seven flights from Hilo to the volcano and return, 134 round trips from Honolulu to Hilo, compared to 100 flights from Hilo to Kilauea.
- **Aloha** made 24 excursion flights from Honolulu around the crater and return, seven flights from Hilo to Kilauea and 90 Honolulu-Hilo round trips.

On the third day of the first eruption, one Convair of Hawaiian Airlines and two of Aloha's transports were showered with cinders from a column of lava and rock that was shot up 1,500 ft by the volcano. Wind-blown cinders fell in places, where they were blowing an estimated 1,000 ft above the crater area, were caught, but no further damage was indicated.

## Alitalia Doubles Atlantic Traffic

New York—Alitalia carried 57% more North Atlantic passengers during the first 10 months of 1979 than during the same 1978 period. Total was 55,727. Capacity was up 44% to 57,103 seats.

The Italian carrier expects to double its available seats and its passenger business next summer with a publicity stunt like the 1963 Olympic Games, to be held at Rome in August. Alitalia plans to introduce a new DC-10 jet service on the North Atlantic by Jan. 1, and to offer daily transatlantic service on the North Atlantic by Dec. 7, 1981.

Alf Breda Airlines carried 32,618 passengers in the first 10 months of 1979, compared with 20,811 in the same period in 1978. The increase was up from 12,716 seats to 16,770 seats. The 1978 and 1979 Al Breda figures were made-up of 12,716 seats to 16,770 seats. The 1978 and 1979 Al Breda figures were made-up of 12,716 seats to 16,770 seats.



By Capt. R. C. Robson

## Wind, Noise and a Hot Water Bottle

In an effort to shield citizens living in the vicinity of Los Angeles International Airport from aircraft noise, the FAA in Draft Bureau 50-17 proposed drastic restrictions on the use of that airport. If adopted, the regulation would require all takeoffs and landings to be made to the west in the daytime and then five knots. Flights departing from this procedure would have to submit a written report within 48 hr stating their reasons for such deviation. Counting that the prevailing orientation direction at Los Angeles is west, this proposal has more bad features. It indicates a surprisingly new knowledge of the operation of weather aircraft as well as the flow of traffic at a major national airport. It assumes a "quartz crystal" attitude, and it provides an adequate amount of control over the airport. It is a proposal to which I can only respond a loud "No."

This plan is an effort to expand the scope of the "predefined runway" notion begun in the New York area about a decade ago and now used throughout the country. Used with extreme operational judgment, this notion is a good thing as it provides for the use of certain runways when conditions are such as a changing factor. Unfortunately, the FAA has been badly overdone. Now the FAA apparently feels that it is necessary to expand the notion by force.

### Wind Factor

The Los Angeles area, of course, specifically aimed at jet takeoffs—the more critical phase of today's aircraft flight. The intent of a transcontinental jet can only be legally accomplished by taking into account every factor and decision point of the wind, noise, temperature, fuel, etc. Every jet pilot still blanches when reading maps of these "legal" decisions. The FAA now has the temerity to suggest that we disregard a wind factor of some 10 ft. (The difference between a five knot headwind and five knot tailwind.)

Furthermore, the proposal is quite vague about everything except performance. Nothing is said about who controls the wind. It is a remote notion, from the airport surface or from high atop the tower? Is this a fancy instrument "interference" by a tower tower on a precision record, to degree and truth at a level of accuracy, printed on a three-colored tape. Let it be considered that tower controllers are understandably reluctant to serve the flow of traffic at a major terminal.

Some astoundingly device working is used to measure a true report of the wind. Sensitive instruments at La Guardia, for instance, will be controlled under the guise of "wind variable," occasionally eight knots until a persistent adverse effect is noted. The wind is then "adjusted" to the north quadrant. But tailored operations continue regardless of this meteorological fact.

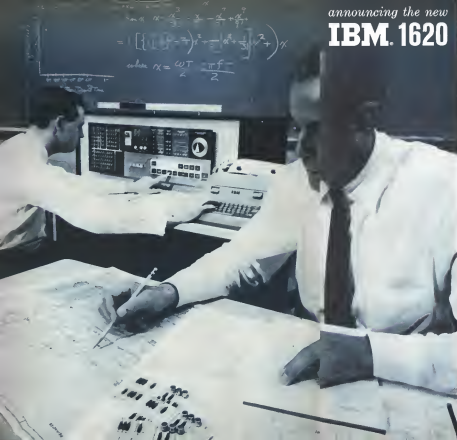
Jet takeoffs are accomplished by "noting" that is, lifting the nose, at a specific point down the runway. Otherwise, one goes straight through the boundary fence. If all goes well, however, one often encounters at the boundary by 25 ft. But the Los Angeles runway, at the retention point, stands about 25 ft to 4,000 ft. So the pilot does it when advised to set of true updraft out of Los Angeles International.

I am sure that interest that, over a number of years of FAA, the people are so worried about the ability (even precisely, let of ability) of human to stop such support businesses on closed takeoffs and on landings that they are concerning some rather extreme device. One of these might be a water-filled supersonic diaphragm, several hundred feet long (and north more than half million dollars) on top of the runway. Specifically it will "warn" the presence of a jet. And so it goes. We will surely witness this battle between the wind and the hot water bottles.



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## AIRLINE OBSERVER

• Scheduled airline flights vary report a record high in the number of accident fatalities. Thus far this year, there have been 17 fatal accidents on scheduled airline operations—329 passengers and crew members have been killed in addition to persons on the ground. Overall, there have been 893 aviation accidents in the U.S. to date. In domestic scheduled operations, 177 passengers and 35 crew members have been killed in comparison with a previous high of 156 passengers in 1955. No pattern of accident causes has been evident, but Federal Aviation Agency is tightening safety enforcement activities during the next 30 days and a stiffening safety inspection of training, flight operations, type-rating, instrument checks and on-board procedures.

► Watch for Lufthansa German Airlines to place an order this week for seven Boeing 720-420 medium-range turboprop transports. Current now has four Boeing 737 intercontinental turboprops on order. Entry to operate a single family of aircraft in its fleet is believed to have tipped the scales in favor of Boeing over the Conquest 600.

★Chicago Helicopter Airways is considering the purchase of two Sikorski S-63s to add to its fleet of six already on order as a result of increasing passenger traffic. The carrier also may revise its tentative plans to phase out its S-63s in the six S-63 turbine helicopters on order as delivered in 1963-64 and seek to expand its routes to include more Chicago suburbs, Milwaukee, Indianapolis and Detroit. CHA now projects revenues in total passenger carried annually to 370,000 in 1963, 500,000 in 1964 and 1 million in 1967 when the six S-63s are in full service.

• **Lake Central Airlines** has completed an engineering evaluation of a Convair 440 powered by Allison 501 turboprop engines. Although operations officials of the airline were impressed with the Convair's performance over Lake Central routes, the carrier is not expected to launch a revivisual program in the foreseeable future. At the recent Assn. of Local Transport Airlines' meeting in Indianapolis (AW No. 25, p. 45), Lake Central Executive Committee Chairman Dr. R. B. Stevens emphasized that prospects for converting to turbine power were dim and that "...we can't even see those costs."

\*British European Airways' load factor on its London-Moscow route has dropped from a summer peak of 55% to a current 25%. To stimulate traffic, the airline will introduce tourist round trip fares of \$285-35% less than current fares.

Initial talks on pooling of airline ground equipment and facilities at major airports have been conducted within the Air Transport Assn. Packaging Committee, but most observers believe that first pooling agreements will be worked out bilaterally—similar to the recent agreement between Air France and TWA rather than on an industrywide scale.

► **Reinforced Caseload for Mutual Economic Assistance's** permanent working group on air transportation has conducted a Moscow meeting of Communist-bloc nations to discuss recommendations for standardizing jet-jet flight rules, conventions and control tower procedures. Nivod has new and modernized commercial airports in eastern Europe and new routes at the airports which are attended by representatives from Bulgaria, Hungary, East Germany, Romania, Poland, Czechoslovakia and the USSR. Delegates from Red China and Outer Mongolia were present in observation.

• **Polar AirFoage**, Finnish aircraft firm, is developing a four-engine transport designed to carry 16-18 passengers. Aircraft, which is being developed without government support, is expected to fly sometime next year. Polar will be tested by 450 hrs. Turboprops: Allison turboprops.

► Venezuela and U.S. delegations met last week in Washington to begin talks on free bilateral air transport agreement between the two countries. Primary purpose of the sessions is to resolve problems arising from the forthcoming introduction of bilateral agreement on Venezuela-U.S. routes.

## SHORTLINES

• **British Overseas Airways Corp.** plans to extend its de Havilland Comet 4 jet transport service to the Caribbean area in February. Actually, BOAC plans the Comet 4 flights per week from New York to Montego Bay, Jamaica, with three flights on a Monday basis and three others stopping at Nassau, Bahamas. The airline reports that the Comet is now in service over the North Atlantic routes are carrying air-cargo loads. Flights on the London-New York route, BOAC says, are running up to 90% of capacity. London-Manchester-Bahia on its 55%.

► **Government** China plans to increase its airline network to at least 48,575 mi. by 1982, last year of the nation's second five-year plan. Present network is over 23,556 mi. Peking now has regular air connections with more than 70 domestic and foreign cities.

► France's around-the-world service, first reported by *Aviation Week* (AW Nov. 9, p. 50), is scheduled to begin May 10 when Transports Aeriens Intercontinentaux extends its across-late Basin Rim in the South Pacific to Honolulu and Los Angeles. The new service will link with Air France flights enroute from Los Angeles as far as Saigon, South Vietnam, where it will connect with TAI's South Pacific operations.

► Pan American World Airways is planning to incorporate Chinese speakers aboard some of its routes from the U.S. to Tokyo and Hong Kong. Applicants must be able to speak conversational Cantonese as well as English. Pan Am has been using stewardesses fluent in Japanese on its Japanese flights for that past several years.

► **Sabena Belgium** Would Airlines is manufacturing seven 20-seat sets of an aircraft seat designed to absorb high decelerations for Air France Seats will be used in first-class passenger cabins on Air France's Boeing 707-320 turboprops. U.S. Air Force also is considering using the seat type seat. In laboratory tests, resistance of the Sabena designed seat to deceleration was about 20g.

► San Francisco International Airport reports that 378,275 passengers flew in and out of the airport during October for an increase of 49,097 persons, or 15.3%, over the same period of 1995. The airport handled 3,627,835 lb. of air- and first-class mail during the month, a decrease of 1.5% from last year.

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## SPACE TECHNOLOGY



ATLAS-ABLE IV payload, containing 150 lbs. of instrumentation on 5-in. steel inside payload ship at most sophisticated space probe package constructed by U.S. Instrumentation was developed by Space Technology Laboratories. Scientific internal temperature is held at about 70° by 18 thin bladed paddles on surface (right), each mounted on a tungsten-carbide post.

## Atlas-Able IV Instrumentation Detailed

Washington—Instrumentation package carried by the recent unsuccessful Atlas-Able IV, the most sophisticated yet attempted (AW Dec. 7, p. 31), was designed to provide more detailed data on the nature of space radiation and magnetic fields in the vicinity of the earth, the moon and the space between. Correlation of satellite data obtained from earth, artificial fragments because of payload limitations, has been difficult because measurements were made at different times, altitudes and locations. By combining several different types of radiation sensors into a single package, together with sensors to measure magnetic field strength and direction and satellite aspect angle relative to the sun, scientists hoped to obtain important new insight into the environment of space.

Atlas-Able IV instrumentation designed to measure radiation included a high-energy neutron counter device used by the University of Chicago are designed to measure "hard" radiation consisting of electrons with energies greater than 12 million electron volts (MEV) or protons with energies above

70 MEV. The device, called a "proportional counter telescope," was intended to measure the high-energy radiation trapped in the earth's magnetic field as well as high-energy radiation coming from the sun. The 7-ft. device consisted of a cluster of six argon gas-filled cylinders surrounding a scintillator. The counter heads, surrounded by a thin lead shield, measured approximately two inches square high-energy radiation particles passing through the lead shield and one of the cylinders scintillates the argon gas, producing an electric pulse. If the particle is of extremely high energy, it also will pass into the outer cylinder and possibly into the counter on the opposite side. The number of counters generated is a measure of the particle energy. The six outer counters were connected to a group of three to also permit the device to register three simultaneous positions (angle, azimuth) in the presence of high field densities.

• Total radiation flux counter developed by the University of Minnesota consisted of an scintillation chamber and a

Gieger-Mueller tube which are sensitive to medium-energy radiation. The two-panel unit was intended to measure the overall radiation changes and the energy levels of cosmic rays from the sun as well as changes occurring during magnetic storms. The sun chamber, consisting of a fluorinated crystal ball filled with argon gas, was an integrating type. The Isotop Gieger-Mueller counter was similar to those carried by the Pioneer III and IV and on the Explorer VI.

• Scintillation counter developed by Space Technology Laboratories, Inc., was intended to measure cosmic-ray low-energy radiation. The three-panel device consisted of a plastic cylinder 24 cm in diameter and a photomultiplier tube. Radiation passing through the plastic produces a small burst of light whose intensity is measured by the photomultiplier and converted into an electrical signal.

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\***Data Handling:** to interpret and relay the target data from TI-equipped drones and recon aircraft to the field commander in usable form.

\***Weapon damage assessment:** verifies weapon accuracy and evaluates the remaining threat.

RESEARCH/DESIGN/DEVELOPMENT/MANUFACTURING of systems for: Air traffic control • Airborne early warning • Antisubmarine warfare • Attack control • Communications • Missile systems navigation • Reconnaissance • Space electronics and on-orbit cells, engine instruments, infrared, radio, microwave, optical, visual, radar, telemetry, time standards, timers, transformers and other electronic devices

**TEXAS INSTRUMENTS INCORPORATED**  
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APPARATUS DIVISION

equipment and power supply was 123 B.

Electric power for the payload was to be supplied by nickel cadmium batteries charged by 8,800 silver zinc cells 10% more than the number carried on Explorer VI. These were mounted on two parallel racks similar to the ones used on Explorer VI. Fuel cells were folded during launch with springs to meet them after second-stage burnout. Solar cells could supply a maximum of 46 watts power in direct sunlight.

A novel method was employed to maintain temperature of the instrument compartment at approximately 70° while the temperature of the payload racks could vary from minus 200° to plus 100°. Developed by SUT, the new technique employed 52 four-bladed propeller-type devices located around the surface of the payload bins. Each propeller was mounted on a temporary sensitive coil in such a manner that changes in temperature of the coil would cause the propeller to rotate slightly. The motor area of satellite bins underneath the payload was cooled with alternate patches of dark material which absorbed sunlight and white material which reflected sunlight.

When the second satellite temperature increased it would have caused the coil to rotate the propeller blades so as to expose the dark (heat-absorbing) area and expose the light reflecting area. When the temperature dropped, the propeller would rotate in an opposite direction so that its blades covered the reflecting surface and exposed the absorbing surface to sunlight. This propeller combination operated independently to provide temperature control of its local area.

More than 35 scientific and industrial firms participated in the program under the technical direction of Space Technology Laboratories. Principal subcontractors in addition to those mentioned, included Electronic Dynamics, Calspan Inc., Holloman Electronics, Minutak, Radstone, Inc., Raytheon Inc., and Space Electronics Corp.

## Air Force Establishes Satellite Test Wing

Washington—Air Force has established its first satellite test wing with the formation of the 69th Test Wing at Palo Alto, Calif., to handle launch, tracking and recovery phases of the Project Discoverer program.

New test wing is responsible to the Air Force Beliefs Missile Division and includes the operations and test squadrons stationed at El Paso which have been participating in Discoverer recovery attempts.

## NASA Asks Patent Rule Change, Proposes More Flexible Policy

Washington—Repeal of the controversial patent law in the 1958 Space Act and substitution of a more flexible set of rules is being recommended to the Patent Subcommittee of the House Committee on Science and Astronautics.

Repeal of the patent provisions, which have been under attack by contractors since the law was enacted, was proposed by John A. Johnson, general counsel of the National Aeronautics and Space Administration, and supported by other government agencies and industry representatives.

Under the present law, inventions on discoveries made in connection with space work become the exclusive property of the government, even though they are made under certain conditions by NASA. The law was patterned after, and is similar to the patent provisions of the Atomic Energy Commission.

Johnson told the subcommittee that a more useful plan would be to pattern the legislation after the National Science Foundation provisions which would permit NASA to adopt policies and procedures suited to fit in particular needs. He recommended that language be substituted for the current provision.

• "Each contract or other arrangement entered into by the Administration, and each subcontract at all times thereafter, which has as one of its purposes the performance of experimental, developmental or research work, shall contain provisions prescribed by the Administration governing the disposition of the rights to inventions conceived or first actually reduced to practice thereunder in a manner calculated to protect the

public interest and the equities of the contractor.

• "The Administration or its designee may, whenever the contract provides for the vesting of title in an invention in the U. S., waive the rights of the U. S. in such invention on such terms and conditions as it determines to be in the best interest of the U. S. Provided that any such waiver shall be subject to the recognition of an irrevocable, nonexclusive, nontransferable, royalty-free license for the practice of such invention throughout the world in or on behalf of the U. S. or any foreign government pursuant to any treaty or agreement with the U. S.

• "The Administration may allow, upon the terms and on provided (the version above) all or any part of the rights of the U. S. to inventions made in the performance of any work under any contract heretofore entered into by or for the Administration which have become the exclusive property of the U. S. Any contract heretofore entered into by or for the Administration on which final payment has not been made may be amended without consideration to effectuate the purpose of this section. Provided that no such amendment shall affect the status of inventions which have become the exclusive property of the U. S.

• "The Administration shall be considered a defendant against the U. S. for the purposes of the Invention Secrecy Act, Chapter 17 of Title 35 of the U. S. Code."

"Requirements of good government" Johnson said, "call for giving NASA greater flexibility as to how to eliminate to

## Transit Satellite Schedule

Washington—Series of Navy Transit navigation satellites now scheduled include these events:

- Transit 1A—Scheduled to be launched before the end of the year. This will use a Thor-Able Star vehicle.
- Transit 1B—Scheduled for launch in or around March, 1960. Vehicle will be the two-stage Thor-Able Star. A Thor booster coupled to the AJ10-104, a new version of the Aerojet AJ10-104A Vanguard engine used in Explorer VI. The 104 engine will have a slight thrust development improvement over the one fitted on the 104A but will incorporate shutoff and restart capability and will have a greatly extended burning time because the nozzles will be about 15 times larger. Photographic equipment is scheduled to be part of the payload.
- Transit 2A—Scheduled for launch in May, 1960. This also will use the Thor-Able Star vehicle and payload will include photographic capability. This project is scheduled to take the place of Navy Signal Corps Cluster 1B, a deep space communications satellite. Army's Courier 1A, a deep space communications satellite, is scheduled for launch about June, 1960.
- Transit 2B—Project not completely firm at this time, but it is scheduled to use the Thor-Able Star vehicle.



# New Titanium alloy takes the lead in rocket case construction

## ...in strength...in weight...in reliability...in price!

*Titanium rocket-motor cases can be built at least 30 percent stronger (see lighter) than best available alternative metals; provide permanent corrosion resistance without protective coatings; withstand temperatures from -400°F to +2000°F; will not absorb moisture which distorts critical parts in storage.*

*Completed assemblies give a spectacular load-cap pay-off . . . immediately; provide a growth potential virtually unlimited.*

*The alloy: Ti-13V-11Cr-3Al, the beta titanium alloy. Now available from Titanium Metals Corporation of America at commercial lead-times (billet, 3-5 weeks), beta may well become the metals story of the year.*



Working of titanium at PMA is based on the company's experience in production of more than 1000 jet engines containing titanium parts. Yield strength of beta titanium alloy is considerably improved by cold working the metal.

The Ti-13V-11Cr-3Al alloy is produced by Titanium Metals Corporation and purchased by P & W. It will be used in the forward cylinders. Bodies are an integral part of the design.

Hot working from roll-rolled rods, enables flexible production of full-size titanium rocket motor cases. It yields round, cylinder diameters and uniform wall thicknesses.



Plus rocket-motor cases manufactured by Pratt & Whitney Aircraft from beta titanium alloy Ti-13V-11Cr-3Al have been consistently handled at levels as much as 35,000 psi — a burst strength/density ratio of 1,340,000.

So successful has been the titanium program that Pratt & Whitney Aircraft considers that production of full-scale titanium cases can be easily realized. Estimated metal burst strength: a conservative 100,000 psi — a burst strength/density ratio of 1,000,000. Readily attainable: 1,250,000.

Reasons for optimism, spelled out by PWA's engineers are:

- "The welded beta titanium alloy is capable of considerable plastic deformation prior to rupture. In welding has improved, the failure occurs have moved into the heat-affected zone of the base metal. With beta titanium, the zone forms, but doesn't fragment."
- "We have successfully tested small scale titanium cases with a steel equivalent yield strength well beyond the 300,000 psi point. Considering that the metallurgy of renewable beta titanium alloys is not far beyond an 80-85, conservatively they would produce strength substantially higher than the 320,000 psi equivalent as being quite possible."
- "Beta titanium has in development (only) 100,000 psi to be equivalent to 100,000 psi steel (which is almost every steel's top limit). But titanium's great potential above other alloys is reflected in the high figure for structural (based on 5% elongation) yield strength. At 100,000 psi stress is equivalent to steel at 80,000 psi, at 200,000 psi beta titanium is equivalent to steel at 150,000 psi. 200,000 psi in beta titanium is possible, and obviously would mean substantially increased payload in the mean as our title states."
- "Again from the aerospace standpoint in the titanium alloy, there is another property of considerable significance. Like other titanium alloys, it has excellent resistance to corrosion under normal atmospheric conditions, in salt water as well as in many other media."

"To avoid developing the long known storage problems with rocket cases — a job it is thought of being can be entombed — we would regard the beta titanium alloy, as the outstanding material under consideration."

### PRATT & WHITNEY AIRCRAFT SURVEY OF ROCKET CASE MATERIALS

#### GENERAL PROGRAM

**The goal:** "A material capable of reaching 300,000 psi yield strength in steel, with a considerable deformation margin."

**The result:** "While this goal had to be modified for steel cases, we have successfully tested small scale titanium cases with a steel equivalent yield strength — beyond the 300,000 psi point."

**Conclusion 1:** "By exceeding reasonable cost, the development of full scale (steel) cases at 200,000 psi is perfectly feasible."

"Steel (and titanium) cases have been built at stress levels as high as 240,000 psi. We are convinced that reliable cases can be designed and built from titanium at yield strength levels of 100,000 psi and over . . . at 100,000 psi titanium is equivalent to steel at 150,000 psi."

"At 200,000 psi beta is equivalent to steel at 300,000 psi. 200,000 psi beta is possible and obviously would mean substantially increased payload to the station as our title states."

#### SPECIFIC COMPARISON: Corrosion Resistance

**Steel:** "All of the low alloy constructional steels which have been discussed are subject to general rusting and, for more serious, to pitting type corrosion during machining, welding, heat treatment, pressure testing and final storage. Corrosion pits are not so severe in titanium and, in comparison with hydrogen, have been demonstrated to cause catastrophic failure. It therefore goes without saying that pitting corrosion is a serious hazard."

**Titanium:** "Like other titanium alloys the beta titanium alloy has excellent resistance to corrosion under normal atmospheric conditions, in salt water as well as in many other media."

"In considering the lightweight strength problem with rocket cases — a job it is thought of being can be entombed — we would regard the beta titanium alloy as the outstanding material under consideration."

#### SPECIFIC COMPARISON: Strength

Steel	Yield	Proof
1040-42	91000 psi	100000 psi
4140-42	115000 psi	125000 psi
4340-42	125000 psi	135000 psi
5140-42	135000 psi	145000 psi
6140-42	145000 psi	155000 psi
7140-42	155000 psi	165000 psi
8140-42	165000 psi	175000 psi
9140-42	175000 psi	185000 psi
10140-42	185000 psi	195000 psi
11140-42	195000 psi	205000 psi
12140-42	205000 psi	215000 psi
13140-42	215000 psi	225000 psi
14140-42	225000 psi	235000 psi
15140-42	235000 psi	245000 psi
16140-42	245000 psi	255000 psi
17140-42	255000 psi	265000 psi
18140-42	265000 psi	275000 psi
19140-42	275000 psi	285000 psi
20140-42	285000 psi	295000 psi
21140-42	295000 psi	305000 psi
22140-42	305000 psi	315000 psi
23140-42	315000 psi	325000 psi
24140-42	325000 psi	335000 psi
25140-42	335000 psi	345000 psi
26140-42	345000 psi	355000 psi
27140-42	355000 psi	365000 psi
28140-42	365000 psi	375000 psi
29140-42	375000 psi	385000 psi
30140-42	385000 psi	395000 psi
31140-42	395000 psi	405000 psi
32140-42	405000 psi	415000 psi
33140-42	415000 psi	425000 psi
34140-42	425000 psi	435000 psi
35140-42	435000 psi	445000 psi
36140-42	445000 psi	455000 psi
37140-42	455000 psi	465000 psi
38140-42	465000 psi	475000 psi
39140-42	475000 psi	485000 psi
40140-42	485000 psi	495000 psi
41140-42	495000 psi	505000 psi
42140-42	505000 psi	515000 psi
43140-42	515000 psi	525000 psi
44140-42	525000 psi	535000 psi
45140-42	535000 psi	545000 psi
46140-42	545000 psi	555000 psi
47140-42	555000 psi	565000 psi
48140-42	565000 psi	575000 psi
49140-42	575000 psi	585000 psi
50140-42	585000 psi	595000 psi
51140-42	595000 psi	605000 psi
52140-42	605000 psi	615000 psi
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54140-42	625000 psi	635000 psi
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59140-42	675000 psi	685000 psi
60140-42	685000 psi	695000 psi
61140-42	695000 psi	705000 psi
62140-42	705000 psi	715000 psi
63140-42	715000 psi	725000 psi
64140-42	725000 psi	735000 psi
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71140-42	795000 psi	805000 psi
72140-42	805000 psi	815000 psi
73140-42	815000 psi	825000 psi
74140-42	825000 psi	835000 psi
75140-42	835000 psi	845000 psi
76140-42	845000 psi	855000 psi
77140-42	855000 psi	865000 psi
78140-42	865000 psi	875000 psi
79140-42	875000 psi	885000 psi
80140-42	885000 psi	895000 psi
81140-42	895000 psi	905000 psi
82140-42	905000 psi	915000 psi
83140-42	915000 psi	925000 psi
84140-42	925000 psi	935000 psi
85140-42	935000 psi	945000 psi
86140-42	945000 psi	955000 psi
87140-42	955000 psi	965000 psi
88140-42	965000 psi	975000 psi
89140-42	975000 psi	985000 psi
90140-42	985000 psi	995000 psi
91140-42	995000 psi	1005000 psi
92140-42	1005000 psi	1015000 psi
93140-42	1015000 psi	1025000 psi
94140-42	1025000 psi	1035000 psi
95140-42	1035000 psi	1045000 psi
96140-42	1045000 psi	1055000 psi
97140-42	1055000 psi	1065000 psi
98140-42	1065000 psi	1075000 psi
99140-42	1075000 psi	1085000 psi
100140-42	1085000 psi	1095000 psi



#### • Reliability and growth . . . the parallel

From P & W Aircraft data reveal titanium cases can be built from 100,000 psi minimum at strength 17 percent greater than alternative metals with beta titanium's strength/weight factor being a constant of development.

A striking parallel exists in liquid-fueled rockets where titanium alloy Ti-13V-11Cr-3Al was selected for helium storage bodies in the Atlas missile because of its strength/density ratio. Arctic Protests, Inc., a leading supplier of the titanium metal, reports:

"These manufacturers in producing techniques and equipment (fitting of tolerances and other variables have shown an increase from the estimated 1000 psi average burst pressure for the present design which is in excess of 2000 psi."

"The best beta steel without increasing the weight of the article by one ounce. Weight of the unit, moderately is controlled to a tolerance of psi as much as half pound, on a weight of 75 pounds and volume is controlled and guaranteed plastic minimum percent."

"While the performance of the titanium pressure vessels has been almost doubled, the price has been reduced about 10 percent — and the metal has become abundant."

#### • When a case fails, so does the missile

The price of completed beta titanium missiles can be estimated at 250 times the price of other missiles. Titanium cases virtually in their infancy. Should the titanium case difference be made, the pay-off would be in two folds.

5. Each engineering time, would be greatly extended, expensive tests. For example, 10 pounds of fuel required in earlier design for each additional third-stage pound) would be saved.

2. Reliability: titanium cases simply will not pit, rust, delaminate, or become hydrogen embrittled.

Added together, these elements mean feasibility—feasibility supported by the commercial availability of the metal itself. Beta titanium alloy Ti-13V-11Cr-3Al is available from Titanium Metals Corporation of America at these lead times: billet, 3-5 weeks; bar, 3-4 weeks; flat-rod, 5-6 weeks. TMCA's metallurgical co-operation with the alloy is yours for the asking.

For further information, write for TMCA Beta Bulletin Add-Info. Titanium for Solid Rocket Motors. Checkmate. Enclose mailing information is included.



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ology, also forms the basis for both NASA and Defense Department contracts, and programs are often jointly sponsored.

Since NASA projects required under the present law differ from that of the Defense Department, Johnson and the disposition of patent rights in events from under contracts that are basically similar and often with the same contractors can depend solely upon whether the source of funds is NASA or Defense Department appropriations.

The NASA general counsel said NASA feels that the government ought to deal equally, regardless of the agency involved, with contractors engaged in substantially similar work. It is therefore, necessary, to assure itself of the continuing willingness of contractors to participate in projects of great national importance that NASA be given discretion authority to adopt contractual patent provisions in line with the Defense Department when necessary to meet the equities of the situation.

Johnson added that the proposed legislation also would enable NASA to adopt patent provisions in its contracts identical with those of the AEC in cases where the production or utilization of special nuclear material or atomic energy is involved. The AEC act provides that inventions made under contract and involving nuclear material or atomic energy will be regarded as having been made by AEC.

### Other Witnesses

Others witnesses appearing before the subcommittee included:

- James P. Folger, deputy assistant secretary of defense for supply and logistics, who said Defense supports the proposed amendment to NASA's statutory patent policy.

- James P. Burns, chairman of the Government Patent Policy Study Committee of the National Council of Patent Law Attorneys, who said acceptance of NASA's proposed changes, until a uniform government policy can be formulated, will make research in the space field more attractive to private industry and help preserve the national functioning of the patent system.

- Charles E. Seaton, United Aircraft Corp.'s patent section, who testified on behalf of Armstrong Laboratories Inc., among the patent possessors of NASA are radically different from one previously permitted used in government contracts in the astronomical and related fields. He noted that NASA be given the same privileges as the Defense Department to issue regulations that can meet the needs of government and, at the same time, protect the public interest and the interests of contractors and subcontractors.



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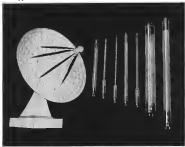
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application be in the laboratory, in field service, or as a component of the system.

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## NASA Urges Project Echo Participation

Washington—Industry, scientific organizations and private experiments are being encouraged by the National Aeronautics and Space Administration to participate on a voluntary basis in Project Echo, the agency's first experiment with a passive communication satellite.

First of three 100-ft diameter spheres will be launched this spring from the Atlantic Missile Range. One perfect will be a 900-m-high circular orbit functioning the earth between approximately 50 deg north and south latitudes.

Full details on the NASA experiments are now planned are contained in a recently issued report by NASA. Interested organizations with suitable antennas and antennas will be free to base on an signals bounced between NASA Jet Propulsion Laboratory in La Jolla, at Goldstone, Calif., and a Bell Telephone Laboratories facility at Holmdel, N. J.

A frequency of 2,390 mc will be used for two-way communication and a frequency of 960 mc will be used for one-way communication. A receiving station also will be operated by the Naval Research Laboratory at Swamp Neck, Md.

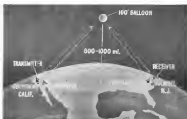
Experimenters also have facilities to attempt to transmit their own signals as well as to receive signals from NASA in Washington, to receive information from experimenters.

### Launch Time

Satellite launch time will be selected to permit the first passes over the U. S. to occur during the twilight hours so that optical tracking can be used to establish accurate ephemeris (orbit predictions). Third-stage motor will carry a radio beacon operating at 158.88 mc to aid in locating the satellite during its initial passes when the third stage is near the satellite. NASA uses two small beacons operating at 167.64 mc and 167.97 mc are being developed by Radio Corp. of America in the hope that they can be attached to the in flight sphere itself without damage to the sphere.

The launching vehicle will be a Delta rocket consisting of a Thor first stage, an Able (Wasp) second stage and an Allegiant (Buller) Laboratory solid-propellant third stage.

Two antennas, one for transmitting and one for receiving, will be in operation at both Goldstone and Holmdel. At Goldstone, the 2,390 mc transmitting antenna will employ an 85-ft-diameter dish with the ability to move in azimuth and elevation. Receiving antenna operating at 960 mc will em-



NASA's Project Echo passive communication satellite experiments will use ground stations in California and New Jersey. Private experiments also are encouraged to participate.



PROJECT plus only for placing 100-ft diameter sphere in a 50-deg inclined, 900-mi high circular orbit, permitting communication with coverage of the area shown.

ploy an 85-ft dish with equatorial mounting.

At Holmdel, Bell Laboratories will employ a 60-ft azimuth-elevation mounted parabolic antenna for transmitting of 960 mc, and a special horn reflector, equivalent to a 28-ft, paraboloid in terms of gain. In receiving at 2,390 mc, the antenna will be equipped with mixer amplifiers.

The antennas will be moved at the antipodal position of the satellite as calculated by the NASA Goddard Space Flight Center near Washington working from optical and beacon tracking data received during the first two passes. Data on satellite position will be transmitted in digital form via landlines to Goldstone and Holmdel where it will be used to automatically position

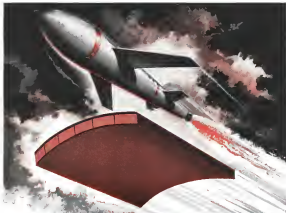
the receiving antennas. Each transmitting antenna will be "steered" to the receiving antenna so that it will be aimed at the same spot on the sky. The 60-ft NRL antenna also will be aimed by means of data received from Goldstone's computing center.

### Self-Tracking System

Once the satellite has been acquired, the transmitter and receiver can be employed as a self-tracking order system with the antennas positioning themselves for maximum signal return.

The initial experiment will employ automatic self-tracking to permit a check on the accuracy of the initial Goldstone center ephemeris prediction. Following this, over transmission using frequency modulation will





## Johns-Manville Announces... MIN-KLAD INTERLOK

... a new structural system interlocking Min-K insulation and high-temperature reinforced plastic

Missile experience shows that in certain heat control situations no one material will perform as well as two (or more)—an insulation with protective high-temperature facing.

Problem is how to effectively combine these materials into a structurally strong unit? The answer is Min-Klad Interlok.



1) Outer facing, 2) bonding resin, 3) Core, 4) Inner facing, 5) Inner facing, 6) Inner facing.



AS the above components combine to provide a unit made structurally strong, easily installed.

—a new structural system that interlocks Min-K insulation and reinforced plastic, metal or other high-temperature facings.

The result: one product that gives the inside designer every advantage of high-temperature plastic or metal (strength, toughness, rigidity, Emissivity resistance). High heat capacity!

plus the increasing advantage of Min-K insulation—an insulating composite, has the lowest thermal conductivity available for service temperatures up to 2000°F (steady-state and higher for transient). Min-K's thermal conductivity is actually lower than the molecular conductivity of still air.

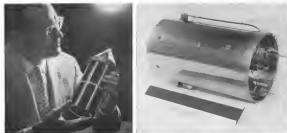
### Wide range of facings

For the hot face, the outside designer can

specify Min-Klad Interlok in a wide variety of heat resistant and/or ablating materials—arabasic phenolic (AKP-40), and similar reinforced plastics, as well as stainless steel and other heat-resistant metal fins and meshes. For some requirements, the cool face can be made of a different material—for example one that offers characteristics required for bonding or bonding to other surfaces and parts.

Like all J-M Aviation materials, Min-Klad Interlok is factory-fabricated to your specifications into external skin panels, heat shields, cylindrical liners or component housings of any shape or size. Write today for technical specifications. Address: Johns-Manville, Box 34, New York 16, New York, or Canada, Port Credit, Ontario.

## JOHNS-MANVILLE



## Satellite Power Source, Ion Engine

Electrostatic converter (left), used designed to produce high voltage for satellite from sun's heat or other heat sources, has been developed by International Telephone & Telegraph Corp. Converter uses an ion-temperature change alone. Modeling it shows under simulated solar heat conditions, dark sections of constant cooling provides high voltage (not shown). At right is prototype of a 2-watt-sized device for long the satellite version control, developed by Electro-Optical Systems, Inc. Propellant source is sodium.

be made to demonstrate the widespread possibilities of a passive communications satellite. These experiments will return to CW instruments to investigate such things as signal modulation, Faraday rotation of signal polarization and fading.

If the 500-watt-hour unit is achieved, going to orbit period of about two hours, the satellite will be visible to both the Goldstone and Haystack stations during any single pass for an interval that varies from 0-16 min.

With an average transmitter power of 10 kw at both stations, NASA scientists estimate that the received signal level at 950 mc will range between -112 and -126 dbm at distances of 1,500 to 3,000 mi from the satellite.

In addition to the communications experiments, Lincoln Laboratories will use its Millstone Hill radar to try to attempt to determine the spin rate of the satellite and the precession characteristics of the sphere at low angles of incidence.

The satellite itself will be fabricated from 82 lbs (gross) of Mylar, 0.0005 in. thick and coated with vapor-deposited aluminum to make it a reflector of radio waves. The satellite is expected to provide reflectivity of 95% or higher for frequencies up to 4,000 mc.

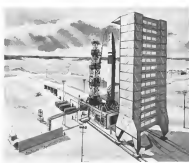
Fast to launch, the deflated sphere will be folded into a 28-in.-diameter container which subsequently will be separated by an explosive charge to release the payload.

After release, crushed air in the folded sphere will cause it to start to expand in the vacuum of space. Two

elastic bags inside the sphere will then appear water that will be vaporized by the sun's heat, building up sufficient internal pressure to inflate the sphere. Water pressure will keep the sphere under positive internal pressure. NASA estimates that the sphere should retain

its shape despite anticipated micro-meteorite damage for at least seven days.

As added insurance the sphere also will contain a sublimating power that will produce a gas to provide additional internal pressure.



## Convair Building Vega Launch Pad

Vega spent rocket, 121-ft high, as shown in this artist's conception of launch complex being built at Cape Canaveral, Fla., by Convair. Cost is \$64.4 million; complex includes a two-story blockhouse (not shown) and will cost more than \$10 million.



# MISSILE ENGINEERING



FOR SAFETY REASONS, chemist (left) uses long tool with slit in the end to test deposit on vacuum rack in which he is synthesizing new propellant material. Deconstructed fuel charging mechanism (right) burns solid, 15 grains, solid propellant samples. Small unit on far lower left is the nozzle.



## Esso Accelerates Solid Propellant Search

By Michael Yaffee

London, N. J.—Scientists at the Esso Research and Engineering Co. here are learning how to work with full-grain containers of solid propellants while the rest of the rocket industry typically works on wet-toroid production of 100,000-

lb solid propellant grains. (ENR, Nov. 23, p. 37). As one of four companies holding integrated research contracts in the Advanced Research Projects Agency program to develop a high energy solid propellant program (AW Dec. 7, p. 32) Esso has had to divide much time and effort in the development of experi-

ment and techniques for handling extremely small amounts of new, potentially dangerous materials—solids, liquids and gases. The company also has had to blend specialists from all the branches of chemistry—organic, analytical, organic, physical and engineering—into a single research unit.



ESSO RESEARCHER (left) focuses search camera on window in end of a nozzle in second burning behavior of a new solid-fuel propellant. Chemist (right) is preparing to compare controlled wet-toroid with other propellant approaches in a V-tube mixing device which will be rotated by remote-controlled valve.



IN THE ANALYTICAL LABORATORY, technicians adjust control knob on panel of vapor refractometer (gas chromatograph) which identifies unknown materials by their characteristic thermal conductivity-time lagged. A hypodermic syringe (right) is used to introduce sample into the chromatograph.



ment is proving successful in both outdoor. Its original one-year contract was recently renewed by ARPA with approximately a 40% increase in funds. The entire ARPA solid propellant program has proven successful enough to justify extension of original contract and addition of new units. Esso Research and Engineering Co.'s part in the program began Dec. 1, 1958. Its original contract was for \$1,264,000, and this has now been re-

newed for \$3,732,000. Actual negotiation and award of the contracts was made for ARPA by Army Ordnance. Esso's first move was to set up a Special Projects Unit at its London, N. J., Research Center which would operate as a separate group within the company. Dr. John F. Langstaff was appointed project director and Dr. John J. Kollerbrock, assistant project director. Directors and staff were chosen from the company to provide a back-

ground in all aspects of chemistry. At once as the unit was ready to go to work, its first task was to decide, on the basis of thermochemical calculations, what types of chemical compounds it wanted to make. From opposite ends of the electro-negative scale, scientists selected a number of elements which, at least theoretically, would combine to form chemical groups (such, as oxygen, etc.) that would release large amounts of energy during



ANALYTICAL CHEMIST studies the magnetic field in a Schlenk-type nuclear magnetic resonance spectrometer to find promising materials which will identify theories of unknown propellant samples. At right, small coil of unknown material is put in place between poles of the large Schlenk-type magnet.







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## NEW SONAR SIGNAL PROCESSOR DOES WORK OF 1,000 UNITS

The first sonar signal processors to utilize true compression are being produced by General Electric. These new processors were developed in cooperation with the United States Navy. Extracting only critical bits of transmitted and received signals in series, one unit can perform as many correlating operations on a continuous signal—as the same unit—on a parallel processor with thousands of units.

Excellent improvements in signal-to-noise ratio also makes these new processors effective against background levels which have formerly made certain signals undetectable by any other practical means. The new equipment is also designed to handle signals from more than one transmitter.

This advance in sonar signal processing is typical of General Electric's many achievements in defense electronics.

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combustion, the further apart two elements are on the scale, the greater their potential energy. Weight, which becomes a particularly important factor in the combustion products, makes out a number of otherwise promising elements.

After this initial rough screening, the thermochroms turn to advances in actual bond energy figures. In those cases where bond energies are not available, the thermochroms have to establish them.

### Compound Formation

From the bond energies, the physical chemist works out the heat of formation of the compound. With the aid of electronic computers, he then calculates the theoretical specific impulse of the proposed new propellant. The compounds that survive these calculations are passed on to the engine and material chemists, who add try to enhance them.

Most of the software work is carried out in a computer tank. This is a rather rigorous matter of plus tubing, tanks and thermocouple values which is evaluated to a precision of 501 out of a million and scaled off from the outside air. Owing to the danger of explosion, only liquid quantities of material are used on the computer—"hot about enough to wet the tube." The more or less is dropped in a small flask behind a thick plastic shield, and the chemists use an extension of rubber original design to soon look, add materials, make adjustments in rate.

The matter is scaled off permits to prevent any material from being lost, particularly gaseous end products. Scaling also keeps possible toxic vapors in the system and out. If enough from the air was to get into the system, it would react with some of the volatile materials, thereby changing their chemical identity.

### Traffic Directors

The thermocouple or stopcock serve as traffic directors, enabling the chemists to separate the reaction products by shuttling out fractions of the material into one flask, closing the flask off, collecting part of it in a separating material through another tube and into a second flask, and so on until all the end products are separated out. Often the chemists get in more as 15 liquid units with each new product they successfully synthesize.

After they have separated the end products, the synthetic chemists try to characterize the different materials by determining their weights, vapor pressures, boiling points, etc. But even after the materials are characterized the synthetic chemist still doesn't know what he has actually made. To find out

he uses his maintained ammonia over to the analytical chemist.

It is at this stage in particular that much ingenuity is brought into play. To find out exactly what the organic and inorganic chemists have actually synthesized, the analytical chemist must run a number of tests on a extremely small quantities of materials. The reason that he has to devise means for testing materials without destroying or changing them is thus.

Typical of the equipment now being

used by Esso's analytical chemists is the Schlenk-type analyzer which determines the hydrogen or fluorine content of a small sample in seconds by a non-destructive method known as methane magnetic resonance. The chemist places a small vial of unknown material between the poles of an electromagnet. The sample becomes, in effect, part of a closed circuit consisting of a magnetic field, a radio frequency transmitting coil and a radio frequency receiving coil. The analytical chemist

## ARPA Solid Propellant Research Contracts

Companies and Programs		Funds/Year (\$000)	
		1959	1960 (est.)
<b>Integrated Programs</b>			
American Cyanamid	Esso Research and Engineering	4,000	4,500
New Chemical	Missile Mixing and Manufacturing		
<b>Propellant Performance</b>			
National Bureau of Standards	Ohio State University	3,720	
University of California	Arthur D. Little		
Bureau of Mines	Allegany-Sullivan Laboratory		
Aerovis Research Systems, Inc.	Robert R. Hunt		
Atlantic Research Corp.	University of Chicago		
University of Wisconsin			
<b>Specialized Synthesis</b>			
Esso Products	Esso Research	3,400	
Esso Research	New York University		
University of Florida	WACO, Marquette Laboratory		
Robert A. Hunt	NRH, NRE (Esso)		
Ohio Matheson	Allied Chemical		
Caltech Chemical	Esso Research		
Esso Research	Esso Research		
Atlantic Research Corp.	National Research Corp.		
<b>Propellant Synthesis Research</b>			
National Ordnance Test Station	National Ordnance Test Station	750	
Ad Propulsion Laboratory	Robert R. Hunt		
Pharmaceutical Research			
<b>High Temperature Research</b>			
Applied Physics Laboratory	Allegany-Sullivan Laboratory	1,000	
Union Carbide Corporation	General Research Laboratory		
Atlantic Research Corp.	Arco Manufacturing		
General Electric	National Bureau of Standards		
<b>Non-Destructive Testing</b>			
Ad Propulsion Laboratory		5,000	
<b>Basic Research</b>			
Bureau of Mines (BRI)	Esso Research	875	
University of California	Esso Research		
Ames Research Center	Aerovis Research Lab.		
University of Texas	Esso Research Institute		
Marquette Research Corp.	Marquette University		
<b>Total</b>		15,000	16,000



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- Flush Mount: Available: Less than 0.01 deg/sec/sec
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Other features of the Type M-100 include: unique quad/lever spring construction to produce greater shock and vibration capabilities than a comparable torsion bar gyro; elimination of one gimbal bearing for lower threshold; maintenance of preload throughout severe environmental conditions through exclusive spin motor construction.

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**H** Military Products Group

### ICBM Detection Tests

Washington—Two high power radars will be modified on Raa Nui Island 45 mi from Johnston Atoll in the Pacific by the Advanced Research Projects Agency for experiments in the problems of detecting and identifying ballistic missile warheads from launch to reentry.

Radar experiments will be conducted during Army evolution of the Nike Zone and ICBM radar on Kure Island in 1962 using special mounted intercept range ballistic missiles with added stages to give it ICBM speeds. Vehicles will be fired from Johnston Island 1,613 mi away.

One of the radars produced by Radio Corp. of America, is a modified version of a tracking radar now being installed at Ballistic Missile Early Warning System (BMEWS) sites. Other radar is being produced by Raytheon. Both will be able to operate on several different frequencies to evaluate optimum frequency for detection of the virtual shift and/or in detection of reentry itself. The program, reported to end between \$75 million and \$100 million, is part of ARPA's Project Detektor and missile defense techniques program.

First traces the transmitting coil to the receiving coil and then varies the magnetic field until the nucleus of the right ratio of radio frequency to magnetic field for resonance to occur. The pre-tension rate is characteristic of (and varies according to) the element in the sample. Using nuclear magnetic resonance, elements can also determine how ferrous and hydrogen atoms are positioned in a particular compound.

Another technique being used by the analytical chemist here is gas chromatography. Small amounts of the newly synthesized materials are placed in the gas chromatograph or vaporizer chamber in terms of a hypodermic needle. Inside the chromatograph is a tube filled with a selective absorbent such as a molecular sieve or a porous polymer. As the unknown sample is a helium carrier, goes through the column, its various constituents pass through the packing at different rates. In effect, the different column separates the different compounds in an unknown sample and permits them to come out the other end individually.

The fractionator measures and records the thermal conductivities of each constituent as it comes out. Every thermal conductive compound will produce a dip on the scaled recording strip at a time that is characteristic for that particular material. The analytical chemist then compares his readings with those of known materials in order to identify the constituents of the unknown.



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The EWB 26 is one of a series of new EWB super fasteners designed as most performance demands of our accelerated technology. And in anticipation of tomorrow's requirements, SPS laboratories are already testing even more remarkable performance fasteners of truly unequalled strength.



Performance characteristics of SPS EWB 26 ultra high strength hex head bolts (tempered up to 550°)

Tensile strength	260,000 psi
Shear strength	210,000 psi
Tail strength	210,000 psi
Fatigue strength	110,000 psi (at 15,000 cycles)

EWB 26 bolts—of common P4 34 lengths—use available form stock in standard sizes (1/16 to 1/2 inch). 34 bolts are certified by vacuum degassing for complete pinpoint data; report see Bulletin 1527.

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## First Photo of Skydart I Rocket Target

Four photos of Cetus Wright Skydart I rocket-powered target for U. S. Air Force (AW Nov. 21, p. 25) shows unit undergoing component testing at the contractor's Santa Barbara, Calif., Division. Rocket motor assembly is contained in black section, airframe, battery and guns are in white section. Target is designed for air launching from a North American F100 or a Lockheed F104. Dual thrust rocket motor is built by Great Coast Rocket Co. and will push the target to a Mach 0.88 speed (AW July 6, p. 38).

simple. The helium burner, which is the first material to come through the column, does not have any thermal conductivity. This non-destructive analytical technique is applicable to any material with a boiling point below 130°C. (Higher boiling point compounds will not hold vapor pressures suitable for gas chromatography.)

Once the new materials are chemically identified, the next step is to experimentally determine thermochemical properties such as heat of combustion, heat of explosion, specific heat, and so on. This is the first opportunity Enso's Special Projects Unit has to actually verify the thermochemical's original calculations that started the group as this particular synthesis. For the most part, conventional chemical equipment, such as a calorimeter, is used for these experiments. If the thermochemical's calculations check out experimentally, the new material goes on to the chemical engineer for compounding with other solid propellant ingredients. If the new material is a fuel, he calculates how much of a known oxidizer it should be mixed with. The chemical engineer is also charged with scaling up amount of the new material from the original 1-gram quantities to 100 grams or possibly several kilograms in order to get the large samples required in later testing.

Mixing a new fuel with an oxidizer is potentially dangerous because there is no way of knowing how the two will

react. The Enso group uses a mixer as usual device called a V-mixer for this step. The mixer is made of a hollow, glass V attached horizontally inside a small glass jar. There is a small receptacle under the tip of both branches on the V-mixer. Fuel is placed in one, oxidizer in the other. The jar is closed, placed on a remote-controlled roller and the two materials are mixed.

At this point in the development process, chemists are frequently faced with the problem of having to build physical properties into their new propellant mixes. The new synthesized fuel, for example, may actually be a liquid, then the chemist must work out a way of using it in a solid system by such means as incorporation, gelling or the like.

The next step is to determine the burning characteristics of the integrated propellant. In one test, propellant is placed in a macro-burner and ignited through a window in the macro-burner reveals the propellant's burning behavior. The Enso scientists also check out the propellant in a conventional thrust burner. From both tests, as these two learn whether the propellant burns or explodes and what effects pressure changes have on the burning rate.

If the propellant comes through this stage satisfactorily, it is then called in a quasi-potential engine. This test tells the Enso scientists whether or not

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their new compound meets further refinement in larger motors.

Manufacture now being used by the Special Projects Unit burn approximately 15 grams of propellant and are fired in a special laboratory. The group hopes soon to have motors that will take up to a pound of propellant. The engine is currently negotiating the small test stands in which the larger engines will be fired. The stands will be located on Eson's property in London or, possibly, they may be built and operated on some other company's property under a subcontract.

For calibration purposes, Eson will fire propellants with known properties in the larger engines along with its new solid propellant motors. The group's work will end when it proves to actual state things that it has a new propellant which meets ARPA's goals.

## Gen. Lee Stresses Anti-Satellite Defense

New York—Need for an active, long-range, anti-satellite defense system, plus an anti-ICBM and anti-satellite defense, were stressed here by Lt. Gen. Robert M. Lee, vice commander, Air Defense Command, before the American Defense Association.

Principal reference of the U. S. during the next two or three years, the general said, would be an precise operation of manned aircraft, with modified techniques to meet existing improvements in defenses.

Emphasizing the need for a powerful nuclear striking force, he stated: "I foresee the threat of general nuclear war increasing" and called for "long-range research with great endurance, a needed addition to our diversified aerospace force."

Initial capability with military satellites will be attained early next year, the group was told by Lt. Gen. Roscoe C. Wilson, USAF deputy chief of staff development. Principal defense systems in the area, now under development, is Mida (Missile Identification Detection and Alarm System) which will be integrated into SAGE and BMEWS. Satellites will provide almost instantaneous warning of the launch of enemy ballistic missiles.

Adaptation for Tactical Air Command of the White Lance missile (Bullpup) developed by the Navy also was noted by Wilson, as was the progressing of additional funds for an advanced fighter, beyond the Republic F-101.

Navy's need of additional surface-to-air missiles, which at present "lack sufficient range," was noted by Vice Adm. W. R. Smithburg III, commander, Second Fleet, who also noted that the Navy will become deputy chief of naval operations for personnel.



Full-scale aerodynamic tests of the Army's Segment ground-to-ground missile have been conducted at AEDC in the 16-1/2 ton transonic tunnel which is 40 ft long. Run of the tunnel was supported by the staff and the perfect engine was not operated. Vice being was required to keep the tunnel from oscillating badly due to the low momentum test setup. Tunnel boundary layer is removed through holes in the wall.



One of a series of acoustic signal tests for the Navy Lockheed Polaris first ballistic missile is shown in a Mach 9 wind tunnel at the USAF Arnold Engineering Development Center. Two halves of the casing show which is kept around the model until the tunnel test conditions are correct, are shown above reflected in the tunnel wall. Proper heat transfer measurements can be made if the model is not heated as the tunnel comes up to speed.



Large scale model of USAF Martin Eson CFM as shown as it is prepared for firing in transonic propellant wind tunnel of AEDC.

## Polaris, Titan Flow Patterns Tested at AEDC

Simultaneous testing of missile airframes and propellant jets under dynamic conditions can be accomplished at the 16 1/2 ton transonic propellant wind tunnel at the Arnold Air Development Center, Tullahoma, Tenn., operated by AEDC, Inc. Photo at lower right shows Navy Lockheed Polaris model under test with its four rocket engines exhausting into the surrounding space which causes even the exhaust products to keep the tunnel air from becoming contaminated. Tunnel during the Polaris test is at near sea level pressure while for the Titan firing test of right, it is at a lower pressure, simulating a higher altitude, and the model exhaust has begun to bloom out filling the mouth of the tunnel. Polaris model is shown at lower left. It has four liquid fuel rockets which can be used in place of a solid fuel engine for these tests.











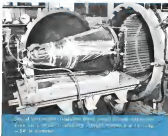




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Quick-opening, self-sealing, 11.5-lb. valves were used for the main Model 8 inside Afters at Epilepsy and South County Air Force Bases were changed and installed by the South Ocean.

## Optical Systems Have Space Potential

Re: Barry Miller

**New York**—Researchers are starting to take a closer look at the optical portions of the electromagnetic spectrum. They intend to use communications and radar systems for extraterrestrial space where atmospheric absorption, scattering and background noise intensities no longer limit the use of optical waves.

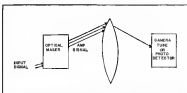
Optical waves occupy that finely defined high-frequency portion of the spectrum which ranges from somewhere in the far infrared, perhaps about 100 microns, down through the middle and near infrared, the visible and into the ultraviolet regions (2,000 to 3,000 microns).

### Potential Rewards

Effective active optical systems may not be easy to achieve, however. Signal sources and sufficient sensitive detectors must be found, and auxiliary acquisition techniques may be required in tracking. But potential rewards of optical systems—long range, excellent accuracy, good accuracy, possible low cost and relative insensitivity to jam-

Some explosive research sponsored by the Air Force is already under way. A West Coast firm has secured a Wright Air Development Center contract for examining a specific optical stress concentration problem.

In January, **Bomb Air Development**



**SIMPLICITY** of possible optical code errors is illustrated. Input signal is amplified to optical Mille then focused into camera tube or photo diode.

Center will award a contract, valued at about \$100,000, for the study of the spectral instability of optical waves, as

will act as coproducer and director with Jefferys. Farnam Optical Co., Inc., Irem, and Technomic Research Group, Inc., in Broomfield, N.Y., are among the bidders for this contract, which will be handled jointly by RADCO and WADCO.

For some of the proponents of active optical systems, the feasibility of these systems hinges on work now in progress on previously unsolvable coherent optical oscillation and amplifiers. Both of these work involves government-backed development of optical Masers at Columbia University (\$50,000 USARF). Office of Naval Research award for the Air Force) and Technomic Re-

month (near million dollar award) from AFOSR for Advanced Research Projects Activity)

Many schemes for making an optical Maser chain follow from Maser action by free precession and under irradiation. Typical of these is one in which a series of coupled oscillators is contained within a 10 cm cylinder with reflecting plates at either end. An electromagnetic wave travels through the medium, is periodically reflected by the plates, and gains energy supplied by a resonant cylindrical discharge tube, and is then controlled through a partially transparent reflecting plate. In all Vekselberg research it is to be working on several different optical Maser schemes involving gaseous, liquid, and solid media. Different pumping methods and resonators are under consideration.

### Adjustable Filters

Large power outputs are expected from some laser systems and, it is argued, it may be easier to obtain high power at optical than at millimeter waves.

Other non-Maser types of coherent generators are in development, including a two to five micron infrared generator at the Aero Division of American Bosch Airco Corp. According to Dr. Berthold Zewen, head of research staff, this device will have electrically adjustable ferroelectric filaments for dismountable against background noise.

Principal advantage of reducing the wavelength for free-space communications below the microwave range, optical wave researchers claim, is the increase of transmitter gain for given aperture size which in turn permits a reduction in required transmitter power.

### Optimum Properties of Optical Receivers

Reference	Mean fig. of output Input Power (mW)		Optical Bandwidth (nm)		Modulation Bandwidth (Hz)	
	Max	Bandwidth	Max	Bandwidth	Max	Bandwidth
Thomson	10 <sup>-11</sup>	10 <sup>10</sup>				
Photocathode	10 <sup>-11</sup>	10 <sup>10</sup>				
Harris Eye	10 <sup>-11</sup>	10 <sup>11</sup>	10 <sup>11</sup>		10	
Photocathode with Mirror post ampl	10 <sup>-11</sup>	10 <sup>11</sup>	10 <sup>11</sup>		10 <sup>10</sup> maximum	
Photomultiplier with optical fiber with apertures	10 <sup>-11</sup>	10 <sup>11</sup>	10 <sup>11</sup>		10 <sup>10</sup> maximum	
Interleaved			10 <sup>11</sup> minimum			
Optical fiber amplifier	10 <sup>-11</sup>				10 <sup>10</sup> maximum (est.)	
with heterodyning			10 <sup>11</sup> minimum (est.)		10 <sup>10</sup> minimum (est.)	
Photo Diode						
Grassman ampl	10 <sup>-11</sup> (est.)		10 <sup>11</sup> maximum (est.)		10 <sup>10</sup> maximum (est.)	
(Kilowatt)	(10 <sup>-11</sup> W)		(10 <sup>11</sup> W)		(10 <sup>10</sup> W)	





## Lockheed picks J&H system for JetStar

Engine requirements of corporate and military flying in an economy-sized jet transport are brilliantly met by Lockheed's JetStar, powered by four Pratt & Whitney JT-12 engines.

For the engine-starting and electric power needs of the JetStar, Lockheed selected a starter-generator system by J&H. This system is self-contained and automatically performs all engine-starting functions except "ignition on" and "fuel on." It also provides all power-generating control and protective functions at the extreme altitude and temperature environments of the JetStar.

Jack & Heintz can meet your electric system needs with equal competence, simplicity, reliability and low weight. Starter-generator systems available from J&H include manual, semi-automatic and completely automatic for the entire spectrum of turboprop, turboprop and turboshaft engines. The systems are particularly adaptable to the new, smaller jet engines rated to 3000-hp thrust. Write to Jack & Heintz, Inc., 17705 Broadway, Cleveland 1, Ohio.

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**22032 STARTER-GENERATOR** engine-driven, air-handling unit for use as engine starter and as 28V-DC power source.



**GC18 CONTROL PANEL**, for use with 220-660 amp, 30V or 28V generator. Includes fuel control and 160VDC and 160VAC control circuitry necessary for single or multi-generator systems.



**GC24 CURRENT TRANSFORMER** for generator and starter fuel circuitry. Transformer scheme has direct output to conventional cloud detector control.

by the square of the wavelength. This power saving is partly offset though by an increase in the minimum detectable signal which beams require. Incoherent power severely with the wavelength. Coupled, the two factors from shorter wavelengths in the ratio of the square to the fourth, or a factor of 16 in 10<sup>3</sup> in the optical range.

Other factors which influence optical communications include the weight and cost of reflectors, antennas, tracking, acquisition of optical waves and return, background noise, interference from the uncollected radiations as the collection of an optical wave are proportional to the wavelength, the weight and cost of reflection of a given size rise at the smaller wavelengths. Acoustic tracking need keep the transmitter and receiver pointed at one another. Required accuracy is proportional to the ratio of wavelength to aperture diameter and is more exacting at optical frequencies because the optical waves need components for the precise constraints of detection in a crossed gain.

### Background Noise

Atmospheric attenuation and background noise increases traditionally with distance electronic functional use of optical communications. One argument is that, as an optical signal from an earth satellite relayed to an optical ground receiver placed in a large and dense area where cloud cover is negligible would be in a useful form in an open space.

Optical communications are advantages in ground use.

• **Aperture** of the transmitter and receiver are limited in size, so is space applications.

• **Security** is desired and jamming must be prevented. If the receiver beam is obtained at optical frequencies, beam is difficult to detect.

• **Frequency** interference by free electrons such as those produced in the upper atmosphere is absent. Again the frequency spectrum is desired.

For a system comprising a 10-m optical laser transmitter, an information rate of 10<sup>3</sup> bits/second, and a detection with a noise equivalent input power of 10<sup>-14</sup> watts/cm<sup>2</sup> and a one-meter diameter receiver aperture, the average power required for 100-km transmission is 100 watts.

While some engineers are looking on the development of coherent signal sources for optical systems, others have suggested both communications and other works using available, incoherent sources. Farwell, which has been making what is generally regarded as short range, high pressure optical radar for the past 10 years, has developed its own optical discharge sources. One millimeter diameter source pro-

Optimum Properties of Optical Beam Generators								
Source	Angular Power (in watts/ steradian)		Power (in watts)		Bandwidth (in cps.)		Frequency Shift (in cycles— second)	
	Peak Pulsed	CW or Average	Input	Output	Trans- mittance	Mod- ulation	Trans- mittance	Stability
<b>Incoherent</b>								
Edison Arc	10 <sup>1</sup>	10 <sup>1</sup>	2x10 <sup>1</sup>	1x10 <sup>1</sup>	10 <sup>11</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>
Other Dis- charge	2x10 <sup>1</sup>	10 <sup>1</sup>		1	10 <sup>11</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>
Edison	10 <sup>1</sup>	10 <sup>1</sup>		10 <sup>1</sup>	2x10 <sup>11</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>
High Pressure	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>11</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>
Minor Arc	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>11</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>
<b>Coherent</b>								
Edison								
Edison								
Optical	(1000)							
Minor	2x10 <sup>11</sup>	2x10 <sup>11</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10 <sup>11</sup>	10 <sup>11</sup>
Microsecond	10x10 <sup>11</sup>	10x10 <sup>11</sup>	10 <sup>1</sup>	10 <sup>1</sup>	10x10 <sup>11</sup>	10x10 <sup>11</sup>	10x10 <sup>11</sup>	10x10 <sup>11</sup>
no set applicable								

vides 4x10<sup>11</sup> candela/cm<sup>2</sup> or rather not brighter than that of the sun, according to E. R. Brown, chief project engineer. The use of this type of source in communications would require pulse code modulation.

### Carrier Frequency

Incoherent communications scheme proposed in Farwell, coherent scheme or infrared light source supplies the carrier frequency which can be varied suitably in increments at some applications. The use then is modulated by conventional means.

Elon Laboratory, Cambridge, Mass., has been studying problems involved in optical communications for the past year according to Dr. Edwin Langberg, the firm's president. Its interest stemmed with a proposal to develop that optical waves might provide convenient communications from space to earth, involving the earth's atmosphere. Optical waves, it was found, are unaffected by thermally caused gas in the short wave spectrum, i.e., entering visible. A recently developed multi-wavelength source (AW No. 13, p. 28) is much more efficient and appears advantageous for this specific problem, Dr. Langberg pointed out.

Elon is continuing its studies of optical communications ideas and own patents under two subcontracts in which Dr. Langberg declined to claim any.

At this present, relative costs of in-

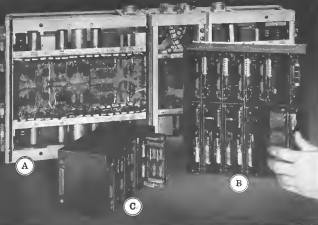
coherent and optical systems appear to be a moot point. One line of reasoning points out that a photomultiplier with a gain of one million would be cheaper and more compact than a vacuum amplifier. On the other hand, an optical transmitter with high intensity flash source suitable for pulse modulation could effectively use only 75% of the reduced power, an efficiency lower than that of a magnetron. Yet neither line of reasoning controls that the weight and complexity of a vacuum source much that for space applications an optical system is cheaper.

### Bandwidth

Some optical frequency proponents argue that it is needed to reduce wavelength as long as the transmitter gain increases faster than the receiver sensitivity degrades. A better wavelength would then be approximately the shortest wavelength at which it is possible to realize a gain proportional to the area divided by the wavelength squared. Gain of incoherent sources such as arcs which is limited by the ratio of the aperture of the source to the area of the receiver, the ratio of aperture to wavelength is a factor of magnitude less than that of potential coherent sources, this argument follows.

In Farwell's pulse transit time of submicrosecond, high intensity, light pulses are required for detection and ranging. The returned signals are detected in a photomultiplier tube and





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Above are three stages in development, showing Stavid advances in high density packaging. Result: less cost/volume/weight.

Unit A, a portion of a guidance system developed in 1966, was redesigned by Stavid in 1968 to adapt it to mechanized assembly techniques. Although no savings was made in components, Stavid achieved a 78% volume reduction and a 69% weight reduction—and added a regulated power supply. (Unit B) Unit C is the package, manufactured through the use of solid state components. As a result of years of experience in designing for semi-automatic and automatic assembly, Stavid has developed an exceptional capability . . . that of reducing volume, weight and production costs . . . and at the same time providing greater reliability, productivity and maintainability in all types of electronic equipment, including the most sophisticated systems.

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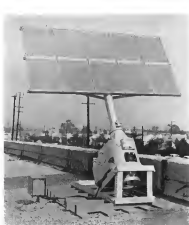
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J. C. PONTIAC, Stavid President  
Engineer, has attended in the development and production of electronic equipment, utilizing mechanized assembly techniques. He is presently engaged in a program of integrated circuit technology for missile systems.



#### Solar Power Converts Salt Water to Fresh

The Nevada, largest solar power conversion ever constructed, supplies 7,000 kilowatts of electricity for converting salt water into fresh water at new Hellman Desalination Center at El Merai, Calif. Ten individual panels of cells can be converted in a variety of combinations to give an output of 0.5 to 5 amps at 60 to 65 v. An automatic tracking device keeps the solar cells pointed toward the sun.

connected circuit similar to that of galena radio. Channel selector is high-impedance wide area, equivalent is lighter in weight, requires less power, and will work ground to ground where solar may be limited by back scatter. Security is its most important single asset and great improvement is reported outside the earth's atmosphere. Where corner reflection can be used, as in freckle identification, signals can be received by an order of magnitude.

Extremely narrow beamwidths of proposed optical Maser, on the order of 10 radians will allow accurate tracking of targets, especially the isolation and tracking of a single target within a cluster of targets. An optical radar with the 10° radian beamwidth might resolve two targets separated by 100 ft at a distance of 2,000 m. Sensor gain should be larger for a given aperture size than that of a longer wavelength sensor.

The optical Maser radar system, for which an proposals have raised the term LIDAR (light detection and ranging) would consist essentially of a transmitter composed of the Maser itself and some variable modulator and a receiver with a Maser preamplifier, a lens for focusing the channel light, and a photodetector.

Primary advantage of this system, its proponents say, would be its high angular tracking accuracy through the search for targets in solid state a relatively long time with the small angles beam width. Supplemented, target acquisition equipment therefore may be necessary.

Thus, in treating an ICBM warhead and other objects from a satellite, the target could be acquired by passive infrared detection during its powered flight and subsequently tracked by LIDAR.

Flexible use of the optical Maser as a

radiation weapon or "death ray" has been suggested but the power densities expected from first generation devices will probably be insufficient to obtain adequate range for a weapon.

#### Temco to Construct Radiation Laboratory

Dallas, Tex.—New 20,000-sq-ft radiation systems laboratory, which will house some \$750,000 worth of equipment when completed early next year, will be built by Temco Aircraft Corp. to augment present facilities now inadequate because of increasing electronic demands.

Structure will include a 20-ft x 20-ft x 40-ft anechoic chamber designed to duplicate radiation-free conditions found in the atmosphere. The laboratory will be under the direction of Dr. Chuan-Chang Lee, Electronics and Systems work center's assistant approximately one-third of Temco's \$300 million orders backlog.

#### 99950 FILTER CENTER 00018

Contract valued at more than \$100,000 covering machining of components for a shielded electronic countermeasures system has been awarded Temco Aircraft Corp. by Sperry Gyroscope Co., Great Neck, L. I., N. Y. Work comprises tool fabrication and precision machining of 16 different aluminum forgings used in the system.

Mechanical communication system production and installation contract totaling over \$2 million has been awarded Collins Radio Co. by USAF Test Station, for Fairchild AFIL, near Spokane, Wash., and provides communication on 7,115.5-490 mc between ICBM control activities and launch sites.

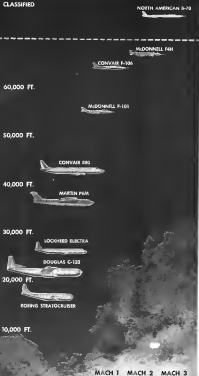
Signal use the Dotted Line-Meter contract awards mostly associated by various manufacturers include the following:

• Communications Division of Hughes Aircraft Co. has been awarded a \$86,400 contract by Boeing-Northrop Co. for study of launch control system communication methods for the Minuteman intercontinental ballistic missile.

• Philco Corp.'s Government and Industrial Division has been awarded a \$6,527,092 follow-on contract for the redesign and installing equipment for the "Quick-Pick" phase of Arcon, USAF's global communications network (AW Feb 25, p. 11).



CLASSIFIED



## General generating

General Electric has been selected to supply the advanced design secondary electrical power generating system for the North American B-70 Valkyrie, the Air Force's new MACH 3 multi-purpose bomber.\* Designed for super-sound high altitude operation with inherent long range flight endurance and large load-carrying capability, the B-70 can be adapted to offense, defense, reconnaissance, or special attack missions.

The new, specially designed G-E system consists of an Inductor-Landell generator, controlled-rectifier regulator, and protective panel. The revolutionary generator, newly applied to aircraft systems, will provide extreme system reliability by eliminating normally required brushes, slip rings, commutators, rotating windings, and rotating rectifiers.

Development of this system for MACH 3 aircraft offers a challenge never before encountered in manned aircraft. New balancing and insulating methods and new study, design, construction are needed to stand 1000 stresses (three times the speed of sound at altitude previously assumed by operational aircraft).

Some equipment will be required to withstand temperatures of 600 F., vibration input of 15 g's (as much as 60 g's locally), and shock of 20 g's. Extreme reliability is, of course, a must.

In developing this equipment, General Electric is using experience and knowledge drawn from the material and component development phase of a separate Air Force high-temperature (HUTELC) Program under subcontract from North American Aviation. G-E's completely equipped research and manufacturing facilities are ideally suited to develop and produce advanced systems like HUTELC and the B-70. And, G-E leadership in secondary power equipment extends through 40 years and more than 50 different aircraft.

\*Illustrated Aircraft is supplier of the B-70 secondary power system to North American Aviation, Inc.

Applies pictured equipment only & does not show for which G-E has developed secondary power-generating systems.

## Electric's new concept in aircraft systems is awarded B-70 contract

### Design Concept

Design innovations in the new G-E generating systems will provide outstanding results in these areas:

• **Reliability**—Key to the increased reliability of the G-E system, is the revolutionary Inductor-Landell generator. Field windings and brushes will be located in the stator instead of the rotor as in conventional machines. Lower component temperatures result from shortening heat-transfer paths between windings and cooling.

In addition, all available control components—relays, transistors, magnetic amplifiers, controlled rectifiers, expander, and ammeter—were fully evaluated as to performance and reliability. Then exhaustive research—conducted by competitors—was conducted on individual circuits of each system to determine the combination of components which would provide maximum reliability and minimum weight for each particular application.

• **Electrical configuration**—It is planned that the B-70 system will consist of four 60-kva generators in parallel for main and emergency power. Through careful system design, these will be a precise integration of generator with necessary control, regulating, and protective components.

• **Light weight**—Unnecessary weight will be eliminated by (1) combining Inductor and Landell generator principles, (2) utilizing the generator frame as flux path, (3) use of more efficient magnetic material in the frame, and (4) integrating bearing and cooling and lubricating systems with the Air Vehicle Standstill Drive.

Weight also will be saved in another way. In analyzing the complete B-70 system, North American electrical engineers felt that the long fuselage nose cone generator to load offered an excellent opportunity to evaluate a variety of generator voltages, feeder sizes, and transformer designs to de-

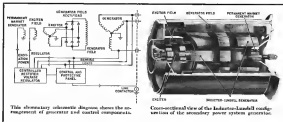
termine the optimum combination. Coordination with General Electric indicated the practicability of such a design breakthrough. As a result, it was decided that power will be generated and transmitted at 240/430 volts and stepped down to 115/200 volts at the load by novel transformers designed specifically for this application. A net weight saving to the aircraft of hundreds of pounds was thus accomplished together with improvement in electrical transmission and cooling efficiencies.

### Future Application

General Electric research on this system holds bright promise for future applications. Further development will make similar systems available in many future fighters and also for other types of aircraft. For more details, contact your General Electric Aviation and Defense Equipment Sales Office or write Section 706-1, General Electric Company, Schenectady 5, N. Y.

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**This is Arizona timber land** where some unperfected fire helicopter fire fighting techniques were perfected during the long-perched summer of 1989.

**Example:** Climbing helicopters at any altitude for often up supply work.

The previous practice—necessary because other light utility helicopters didn't have the power to hover at the density altitude—called for heliops to wait to jump into the brush from a helicopter in flight...a stiff order even for the tough Zivko Indian four-place.

This summer a new 205 hp Hiller 12E, operated under forest service direction by James M. Meade Helicopter Service, Watsonville, Calif., easily hovered steady as a platform while the firefighters eased themselves down to knock out the heliops. The task seemed far less hazardous.

The Hiller 12E's incomparable performance is opening up new techniques in many forest operations... increased tanker capacity, greater work speed for fire fighting and faster per acre seeding and spraying are but a few.

The Hiller 12E is the most powerful helicopter in its class: its 205 usable horsepower actually matches the power of all but the largest helicopter. Put this rugged, dependable helicopter in the true hands of a Hiller Charter Operator and you have a truly elite, elite service.

**He invests in the best value available so you can have the convenience and economy of obtaining by the flight or by the contract. It's worth looking into. You'll know right away whether the 12E will make substantial savings in your operation. Write today for free literature, "New Workhorse for Forest, Farm and Ranch." Commercial Division.**



## BUSINESS FLYING



SHERIFFS Helipad is located in 180-acre county administrative center. Communications center is located at the foot of the hill behind the helipad. Coach Field Department, which uses one of the helicopters, is within fire radius of the helipad.

## Sheriffs Use Bell 47s for Patrol Work

Los Angeles-Vernon utility helicopter demonstrates non-sold operations in Los Angeles County Sheriff's Department Auto Detail—a case now tactical on force for an approximately 5,500-sq. mi. area and a community of about 20 million people.

Multi-titled pilot-depth Sheriff's of Auto Detail acknowledge the special capabilities of more numerous helicopter now on the market but would object to a one-for-one exchange of their three Bell 47G and 47G-2 utility machines. Their line is based on operational advantages of the light helicopter, but not show rules such as exchange responsibility, competition for tax dollars being what it is. Total capitalization of Auto Detail including three helicopters, two light fixed wing aircraft, two trucks,



DOGS used in search and rescue operations by Los Angeles County Sheriff's Department are loaded on their launch on Auto Detail's helicopters.





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Douglas Aircraft Company, Inc.  
Santa Monica, Calif.

a tax, freight, machine tools and miscellaneous equipment is less than \$163,000. Annual operating cost including salaries and maintenance is a little more than \$75,000. The detail here old military Bell helicopters and manufacturers them for spare parts.

Because of the variety of missions thrust upon a law enforcement agency and rapid turnover of the country, the utility helicopter has largely displaced fixed wing aircraft. In the last half of 1984 and the first half of 1989, Aero Detail's three helicopters flew almost seven times as many hours as its two fixed wing aircraft. For most missions, a dispatch sheet must be in the sector in person, and only the helicopter makes this possible while offering quick access to undeveloped areas. The greatest usefulness of fixed wing aircraft is found in search and patrol work, but even for this mission the helicopter is now more frequently used. It lowers the design potential of mountainous terrain to restricted utility.

### Types of Missions

Aero Detail missions include:

- Enforcement of California Accruals: Commission Act which prohibits Civil Air Regulations.
- Forest and brush fire suppression.
- Recording of helicopter wreckage to prevent erosion damage and subsequent damage.
- Search and rescue of missing aircraft, boats and persons.
- Protection of airports and general aircraft against theft and damage.



LANDING spot for Sheriff's Aero Detail Bell 40G was hoisted out of heavily hillside by reverse who jangled from leaving engine and cleared the way with hand tools.

- Patrol and atmospheric measurement for Los Angeles Air Pollution Control District.
- Transportation of county technicians and officials.
- Photographic survey.
- Capture of escaped prisoners and other criminals.
- Delivery and posting of court orders in otherwise inaccessible areas.

### Outside Cooperation

With its limited resources, the detail's job would probably be impossible without close cooperation by outside groups in private industry, other divisions of government and other county executive departments. Its central help post is located within a 10 mile drive of the Hall of Justice in downtown Los Angeles at a 100-acre county administrative complex which includes the Fire Department, Communications Department, Sheriff's Academy, Public Works and Civil Defense Headquarters. One of the three helicopters is permanently assigned to the Fire Department, though trained and maintained by Aero Detail. When a fire report comes in, the pilot drops on duty at the helicopter is alerted in telephone. A helicopter is standing on the ramp with the rotor turning and the door open within five minutes it takes the fire chief to make preparations and drive to the helipad.

Communications Department operates several automatic radio stations to maintain contact with Fire Department and Sheriff's units throughout the county. Police of a sub station is



The care and feeding of a

missile system



It takes more than pressing a button to send a giant rocket on its way. Actually, almost as many man-hours go into the design and construction of the support equipment as into the missile itself. A leading factor in the reliability of Douglas missile systems is the company's practice of including all the necessary ground handling units, plus detailed procedures for system utilization and crew training. This *complete* job allows Douglas missiles like THOR, Nike HERCULES, Nike AJAX and others to move quickly from test to operational status and perform with outstanding dependability. Douglas is seeking qualified engineers and scientists for the design of missiles, space systems and their supporting equipment. Some immediate openings are described on the facing page. Please read it carefully.

Alfred J. Cerah, Chief Design Engineer, discusses the ground handling requirements for a series of THOR-boosted space probes with Donald W. Douglas, Jr., President of

**DOUGLAS**

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AIRCRAFT CORPORATION

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## ROHR advances the state of MANUFACTURING art through RESEARCH

To preserve its role as the world's largest producer of components for flight, Rohr gives high priority to its manufacturing activities. This involves conception of future customer needs, evaluation of those needs in light of Rohr's capabilities, and implementation of new techniques and methods when required.

Manufacturing research is typified by explosive forming, illustrated here. Rohr began work on this technique in 1949 and more than 35,000 sound suppressor tubes have been produced using this method. Final forming of the Rohr-fabricated production units is by the Olin Matheson Chemical Company under a sub-contract. Such research means better products at lower cost to Rohr's customers.



likely to mean loss of radio contact with units in parts of the country blocked off by monsoons. In so-called, relay stations are often needed in some areas as there are located on mountain peaks. Aero Detail provides fast transportation for Communications Department technicians to get relay stations back into service quickly.

Since 1947 Aero Detail has headed a permanent Aircraft Emergency Coordinating Committee which not only sets up to cope with all the details of commercial aircraft taking off from Los Angeles International Airport. Since then, the scope of the agreement has broadened to include one emergency landing or crash. Other members are Coast Guard Rescue Co-ordinating Center, Long Beach, Calif.; Los Angeles Air Route Traffic Control Center and other FAA branches, USAF, all air carriers operating in the Los Angeles area, and all local aircraft manufacturers.

### Search Teams

If an Air Route Traffic Control Center communications search fails to find an overdue aircraft at an airport or in flight, controllers, members are notified by telephone and Aero Detail in turn notifies California Highway Patrol, city police, county patrol cars and fire stations in the immediate area. Aero Detail and AITCC, alert aircraft in flight. Aircraft manufacturers maintain highly efficient search and rescue teams and a highly fast emergency communications system in support of their flight test operations. Each of these groups has found lost aircraft or conducted successful rescues.

To fight forest fire and second burned area land, state, county and U.S. forest services have aerial and districts within which they help each other on these tasks. It is quite common to find aircraft, ground equipment, and personnel of all three working on the same fire or rescuing people. Cooperation with military and agencies is generous rather than strict and no one crosses the distinct boundary before starting the job.

Vehicle rescue for Aero Detail is the 100 member Sheriff's Aero Squad, persons whose members serve without pay and lead their aircraft on crash, business without any charge for fuel and oil. Fourteen helicopters and a varying number of fixed wing aircraft are available through's aviation members. Several aircraft company but pilots are members of the Aero Squadron. Fast reconnaissance aircraft of aviation members are sometimes used to bring back important persons from other states. Perhaps the biggest part of the detail's time is spent in enforcement of the State Aeronautics Law which parallels many parts of Civil Air Regula-



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**Lockheed ELECTRA's**  
temperature...to 1°C.



Accuracy 0.1%  
Range 0-150°C

High accuracy, and excellent model power plus digital in-line counter readout, are the principal service features of the B&H AUTOTEMP. It is an optical temperature indicator. AUTOTEMP is designed and produced by the makers of the SETCAL Analyzer, the only jet engine tester used throughout the world.

The AUTOTEMP is completely new instrument, a convenient and reliable 144-inch diameter potentiometer combined with a linearizing analog-to-digital converter. Its accuracy is the simple arithmetic or photoelectric of its read and basic electronic potentiometer.

Self-contained, self-heating, battery-powered, maintenance-free, the AUTOTEMP's 144-inch diameter unit includes a zero reference, power supply, amplifier, remote sensor, cold junction compensation and the 144-inch diameter and punched tape to linearize thermocouple output for most, constant-type digital readout. The remote potentiometer in 30°C increments over the 0 to 1200°C full range of the unit.

Full information is contained in our Bulletin B&H-1 available for the airport.



**B & H INSTRUMENT  
CO., INC.**  
247 West Valley Blvd. • Port Webb 2, Texas

Sales Engineering Office: 4400 E. 1st St., Suite 100, Denver, CO 80202. Tel: 303-733-1111. Telex: 150000. B&H. (Denver) 303-733-1111. (Los Angeles) 213-733-1111. (New York) 212-733-1111. (Chicago) 312-733-1111. (San Francisco) 415-733-1111. (Seattle) 206-733-1111. (Portland) 503-733-1111. (San Diego) 619-733-1111. (Phoenix) 602-733-1111. (Dallas) 214-733-1111. (Houston) 713-733-1111. (San Antonio) 512-733-1111. (Austin) 512-733-1111. (Fort Worth) 817-733-1111. (Phoenix) 602-733-1111. (San Diego) 619-733-1111. (San Francisco) 415-733-1111. (Seattle) 206-733-1111. (Portland) 503-733-1111. (San Jose) 415-733-1111. (Oakland) 415-733-1111. (Sacramento) 916-733-1111. (Fresno) 209-733-1111. (Stockton) 209-733-1111. (Modesto) 209-733-1111. (Merced) 209-733-1111. (Yuba City) 714-733-1111. (Wichita Falls) 817-733-1111. (Amarillo) 817-733-1111. (Midland) 817-733-1111. (El Paso) 915-733-1111. (Las Vegas) 702-733-1111. (Nevada) 702-733-1111. (Salt Lake City) 801-733-1111. (Denver) 303-733-1111. 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## The increasing importance of **AIRLIFT**

Even in peacetime, airlift plays a vital role in supporting our missile bases, airborne combat forces, and strategic and tactical operations throughout the world. In wartime, the airlift burden would increase a hundredfold. America's airlift capacity must keep pace with other top-priority projects so that it can provide the support needed to keep them in operational readiness.

Three years of world-wide service with the U. S. Air Force have demonstrated conclusively that the Lockheed C-130 prop-jet HERCULES transport will provide the most Jet Age airlift per dollar.

**LOCKHEED**  
GEORGIA DIVISION



Sixty-four fully equipped paratroopers can jump from the C-130 Hercules' two aft side doors in 32 seconds. Heavy equipment drops can be made with pin-point accuracy from this huge 9-foot by 10-foot rear door.

20 tons of critical military cargo can be loaded or unloaded in 40 seconds, using Lockheed's Lightning Loader system. This time-saving feature of the giant C-130 assures rapid mass airlift in minimum time.





### Nord 1100 Turboprop Enters Flight Tests

Flight tests of the Nord 1100 turboprop engine plane are under way following successful static light at Boeing. Plane is powered by a Turbomeca Astrom turboprop engine developing 1500 hp. Engine was adapted by Nord, Turbomeca and Keller Flug.

ness Aero Detail Capt. Sewell F. Griggs sees more violations of general flying rules are reported to the Sheriff's department than to any other aviation agency in Los Angeles. This is because private citizens and local officials who report the majority of such violations as law flying are more accustomed to dealing with local law enforcement agencies than with federal agencies. More often than not, investigation reveals that no violation has really been committed. Aero Detail has carried out

an educational program to teach well placed observers what constitutes a violation. The lectures are a historic account of operations from law flying violations, to conferences with legalists have been particularly rewarding.

Conferences have also been held with airport agencies to inform them of the detail's existence and set their cooperation in reporting violations committed near airports. This has been so effective that agencies played with major radio transmitters ask the detail to park

one of its airplanes in a conspicuous place on their flight base. This has been found to operate consistently with the rules.

An annual problem for the Sheriff's Aero Detail is the New Year's Day Rose Bowl football game and parade which inevitably attracts a crowd of airborne rubbernecks. Rules prohibit in advance against aircraft in the air above 1,000 ft. and Aero Detail usually try to lead them into a left hand circle. However, there is always a percentage which goes the wrong way. A collision over the crowded stadium and streets would be a major catastrophe. The detail must cope with a strong movement of aircraft over the game. They have had anti-aircraft batteries, towed gliders, light planes and towed advertising banners in the same respect at the same time. Military jets occasionally pass through. Visibility is usually limited, for this is the most capital of the world. Even so the detail permits 15 or 20 low flyers. The strict presence of detail aircraft bearing the no control gold star of the Sheriff's Department undoubtedly reduces the hazard more than the usual crop of visitors report. The value of the information in a situation of order, however, has been given by patrol cars on Los Angeles freeways.

Sightseeing are also a frequent problem over local areas where they interfere with the already hazardous operation of airlines and sports planes. As in the Rose Bowl parade, the detail's Cessna 182 and Stinson L-5 are often used to ward off intruders. A complete file of county-based aerial and known violations is kept in the detail's office. Low flies are penalized in their habits and

can often be caught in stationing a sheriff's airplane over the area at the same time a word later.

Aero Detail has developed considerable skill in bush flying because of the wild and mountainous character of a large part of the county. County Five Department has learned to provide high-altitude ground support for this type of work.

Sheriff's Department has treated 25 deputies from which to down isolate cases who are the county's airborne troops. In addition to law enforcement police duties, a helicopter was used from the detail of a helicopter hovering 8 to 10 ft. above the ground and back out a crude landing spot as a mountain-side with a bush back and a Puma, the helicopter built mounted, and built as developed for fire fighting. Aero Detail owns two trucks, which provide ground support for the helicopters during prolonged operations from an advanced base accessible by road. Each truck carries a 115-gal. tank of helicopter fuel and a transfer pump. Aero Detail's machine and a supply of repair spare parts for running maintenance can also be brought to the scene in the trucks.

### Attractable Equipment

Two new sets bring along much accurate, attractive equipment at \$1000, latest, powerful headlights, water pump, large to extinguish spot fire, power drill, portable water pump and bomb shelter control base tank with which a helicopter can lay fire hose up a mountain side in a fraction of the time it could be done any other way. The plane takes an automatic control wire, accessible places on the bank available and dropped to launch retracting county-owned private fires after a fire.

The same lights and techniques are as useful in search and rescue work as in fire suppression. With the helicopter it is now possible to find and investigate a mountain creek site within a few hours. Formerly, when fire was caught in a creek and mountain parties had to pack into the site, the investigation could take a week.

A typical operation occurred recently when three deputies were lost while a few miles of residential neighborhood is mountainous to rugged that the home of a member of the search party did over a cliff and was killed and a pack was left down a hill, reaching nothing but a man carrying. An Aero Detail helicopter found the lost man in the bottom of a deep narrow ravine. Girth, canyon mouth prevented an immediate rescue. Food drops were made while waiting for words to retrieve. A helicopter was later hooked out of the break and the rescues were taken out from there to a road camp and a base during the search. The posse member who lost his horse had to be rescued by helicopter, too.

Bloodhounds are often airlifted into the mountains for such searches as a pack of small running leashes mounted on the helicopter's deck. Hops, jumps do not have to cope with aerial dogs. The bloodhounds like to fly and strain at their leashes to bound the helicopter.

### Ferret Flies

After a forest fire Aero Detail then find control district reports up to the barn to estimate damage. Its presence there, however, once land is reseeded from the air with special grains selected for the speed with which they take a deep extensive root system. Timing of



### Cessna Plant Addition Nears Completion

New addition to Cessna Aircraft Co.'s Industrial Products Division plant at Hattiesburg, Miss.—(Shreveport) is nearing completion. Approximately 1,000,000 sq. ft. of space is scheduled for completion in January. Cost is about \$1 million.

BASIC  
BUILDING  
BLOCKS  
FROM KEARFOTT



### TIME INDEX DIGITALIZER

This versatile analog-to-digital converter (YADAC) displays time values in hours, minutes and seconds and simultaneously transmits this information as a coded electrical signal by means of coded relays, photocells and switches and push-off buttons. Driving pulsed address drums and reference drums are provided from external, non-supplied sources.

#### TYPICAL CHARACTERISTICS

- Range: 00 00 00 to 23 59 59 hrs.
- Input Pulse Frequency: 1/400
- Input Pulse Form: Square
- No. of Input/Output Generators: 1000's
- Manual Color: White on Black
- Code: Binary decimal
- Step Time: 30 msec. max. 15 msec. min.
- Operating Temp.: 50° to 125° F.
- Switch Load: 50 ma.-40 Vdc.
- Operating Temperature Range: -50°C to +70°C
- Reliability: 100,000 hrs. per MIL-E-13723, Part I
- Wavelength: 100,000 hrs. per MIL-E-13723, Part I
- Shock Resistance: per MIL-E-1600, para. 3.2.2.2.1
- Weight: 1.75 lbs.
- Operating Life: 3000 hrs.

Write for complete data.

**Kearfott**

A  
GENERAL  
PRECISION  
COMPANY

KEARFOTT COMPANY, INC., LITTLE FALLS, N.J.  
100 West 10th Street, Little Falls, N.J. 07424  
In New York: 201-781-1000  
In New York: 201-781-1000  
In New York: 201-781-1000  
In New York: 201-781-1000



### Atlas Helicopter Accepts First Vertol 44

Atlas Helicopter Service, Inc., of Omaha, Neb., has taken delivery of its first 1519 piston engine Vertol 44 helicopter and B. T. Buewa, Atlas vice president and general manager, said others will be purchased as requirements indicate. Newsh-diamond companies will use the Vertol on pipeline jobs, oil exploration, survey work and charters.



**5 ounces of compact control...**



tiny new  
flow control  
transducer  
by **HYDRAULIC  
RESEARCH**  
features  
ultra-high stability  
for high  
performance  
control systems

Control flows to 1 gpm; Orating temperatures to 450°F; Pressures to 4000 psi; Hysteresis 3% max; Threshold 5% max; this is the new Hydraulic Research Model 25 Servo Valve. ■ Never before have such performance characteristics been built into such a small unit—with insured dependability. The Model 25 is a miniature of Hydraulic Research's proven Model 26 Flow control Transducer, and utilizes the same unique spool position feedback powerful dry torque master central filtration and stainless steel construction. Selection of sealing material permits choice of use in hydraulic fluid or mono-propellant systems. Modifications may be made for specific requirements. Write for complete specifications.

**HYDRAULIC RESEARCH**  
*and Manufacturing Company*

2815 N. Magni Street, Burbank, California



## Hiller 12E Operates in Alaskan Mountains

[illegible]

the re-seeding operation can be critical. If it is done too early in the year, the seeds will not germinate because of the long dry summers. Late in the year when rain potential is up, it is customary to reseed immediately after the fire is out to get the root set down into the ground before erosion begins.

### Arson Patrol

When an amount is known to be working in an area and a description of his car is available, Aero Detail will sometimes patrol the area by helicopter in the hope of catching him or at least lightening him away before any damage is done.

For emergency ambulance duty, even a few details of telephone carries a life to aid the police in finding out the emergency. Hospitals make contact to the county. Each list includes a map showing hospital locations. Each entry has an area for each hospital has been preselected and a description and photograph of the site are part of the hospital selection list. At some hospitals, Sheriff's Department radio can most block all a screen of health and to make a useful looking site but new hospitals are being designed with good outlook on brain health.

As an Detrol non-competitor of six pilots, five of whom are deputy sheriffs, one mechanic, one ordinance officer with responsibility for all county-owned weapons who doubles as an assistant air clerk, and one secretary. The Detrol does all its own maintenance except engine overhauls. Two of the deputy sheriffs are test mechanics as well as pilots.

The caliber of preventive waste management is indicated by the fact that Astra Detroit has not even had to cancel a program because of a mechanical problem.

### Overhead Cycle

[illegible]

## BASIC BUILDING BLOCKS FROM KEARFOTT



## INTEGRATING MOTOR GENERATOR

This high performance unit is the smallest of its type available today. Accurate in the Rosemount tradition, this meter generator is thermistor compensated and characterised by an output of 5V/5000 RPM, linearity of .04% from 0-5000 RPM and output variation of temperature (-35°C to +35°C) of not % from the value at 25°C.

#### TYPICAL CHARACTERISTICS

MOISTURE SECTION	Phase 1	Phase 2
Wetlage (mm)	20	40
Frequenz (Hz)	600	600
Querschnitt (mm²)	110	177
Phasen (mm)	0.0	0.0

**GENERAL NOTE**

Endoline 200 MHz 600ms 100amps.
1.4 volts
Volt @ 1000 RPM
Power Volt @ 2000 RPM
In Phase Volt Excl (mV)
Quadrature Axis Error (mV)
Current @ 2000 RPM (A)

## MICHAEL M. CHAGALOFF ET AL.

Height (in.)	14
Max. Load Speed (RPM)	3300
Shelf Length (in.)	6.25

Write for complete data.

**Kerzfett**

### GENERAL PRECISION

**HEARTY COMPANY, INC., LITTLE FALLS, N.J.**  
A subsidiary of General Electric Company, Inc.  
Sales and Engineering Offices: 300 West Ave., Chicago, Ill. 60601  
Telephone: CH 1-1000, 24 hours. In Canada, 416-291-1000  
South Carolina Office: 401 S. Second St., Spartanburg, S.C. 29583  
Miami Office: 3301 N.W. 10th Ave., Miami, Fla. 33125





COMANCHE 250 equipped with Edo 254-2700 amphibious floats. Ultimate performance could approximate that of the Cessna 180.

## Comanche Tested As Seaplane, Amphibian

New York-Edo Corp., which has installed its standard Model 254-2700 amphibious floats on its own Piper Comanche 250, is optimistic over the airplane's potential as either a seaplane or an amphibian. Piper is expected to offer the airplane in one of these categories.

Comanche 250, powered by the 250-hp Lycoming O-540 air-cooled engine, normally cruises at 165 mph. Performance and speed with floats, which now approximate 170 mph, is expected eventually to be on a par with that of Piper's Comanche 350 (AW Nov. 2, p. 108).

Installation of floats by Edo was made for two purposes: to permit study of the amphibious drag reduction of Edo float installations and to permit evaluation of the Comanche as a pre-septate seaplane and/or amphibian. Choice of the airplane for the former was due to its relatively high performance as a land plane suitable for float installation, Aviation Week was told.

Floats currently installed were originally developed for and licensed to the Cessna 180. This model float was elec-

trically actuated and is currently in place on Edo's Model 419-2700 amphibious float which is hydraulically actuated. Hydraulic power stems from an engine-driven pump or a hand pump at the option of the purchaser.

### Four-Month Program

During a four-month program of drag cleanup, the cruise speed performance of the Comanche amphibian was estimated approximately 70 mph. Edo believes this can be further improved and is continuing in this program. Alterations to standard float installations are being made in a manner suitable for similar application to Cessna 180 installations in that the cruise and top-speed performance of the 180 would be progressively boosted.

Standard Comanche propeller (77-in. diameter) has been replaced by an 80-in. diameter Hartzell designed to that used in Cessna 180 airplanes except that, in the case of the Comanche, it is feathering. This float, according to Hartzell, was to permit using the power-off glide technique developed by De Angelis Report of Marseille

State University (AW Nov. 30, p. 67) for evaluating drag reduction. The 80-in. diameter propeller has enabled the Comanche to develop similar takeoff performance to the Cessna 180 seaplane. It does not affect cruise or top speed. Cost of the Comanche 250, with floats, would be in the neighborhood of \$14,000. Its components, the standard biplane version costs \$14,500 and Piper's paper custom biplane version costs \$22,500.

Edo's experimental amphibian-a semi-biplane configuration that generated considerable interest-was also placed at the recent Piper distributor meeting at Wilkes-Barre, Pa. Despite this a preliminary to the making of the distributors about their level of optimism over the airplane's sales potential. Overengineering is not yet complete.

Trading deacons to earth, the Comanche in this configuration, it is not yet certain whether the airplane would be amphibiously licensed as an amphibian and seaplane or just as a seaplane. Amphibious float capability means the additional expense of approximately \$50 lb. at gross weight.

## NEW AVIATION PRODUCTS



### Plastic Compressor Housing Tested for Jet Engine

Pressure-cold plastic compressor housing successfully completed a 150 lb. test on a Westinghouse J501E-16 turbojet engine. Tests were conducted by the Civil Turbine Division of Westinghouse under Navy Bureau of Aeronautics contract. The material, a polystyrene resin reinforced with glass cloth, is not to be lighter, lower cost, more corrosion resistant and easier to manufacture than metal housings. The material is stronger than aluminum or magnesium at temperatures above 450°.

### Flight Instrument Calibrator

Flight instrument calibration makes certain flight test calibration of instruments. Manufacturer and airport maintenance is approximately 75 cents. The test equipment permits one man to make a complete check of an aircraft's



### Fire Extinguisher Valve

Low extinguisher selector valve controls flow for extinguisher fluid on commercial aircraft.

Model MV-175A selector valve is electrically controlled from the cockpit. Weight of the arm linkage valve is less than 1 lb. port size 1 in. assembly closed operating pressure 750 psi, operating temperature -65 to 160°.

Minerva Valve Corp., P. O. Box 100-10, Broomfield, N. J.

### Metallic Hydraulic Head

Hydtek, metalhydraulic, constructed metal hydraulic hose withstands temperatures from -150 to +1,200° and is designed to withstand metal hydraulic shock loadings at 4,000 psi.

The flexible hose, called RT-69, consists of an outer and inner layer of

BASIC  
BUILDING  
BLOCKS  
FROM KEARFOTT



### PRECISE ANGLE INDICATOR

Combining of an angle position indicator, marker and servo amplifier, this small electronic ink panel recorder of angle position angles, position and indicators for laboratory, production and field use. Input signals proportional to unknown angular position of working device being measured can be recorded as an exact replica, which is amplified and used to drive an internal servo loop to null. Center mechanism then provides direct visual readout of angular position.

### TECHNICAL CHARACTERISTICS

Input Signal: 0.5, 1, and 5, of external voltage (transducer). Reproducibility: Within 0.04 minute in either a clockwise or counterclockwise direction for any angle position.

Resolution: 0.5 minute through full range from zero to 360°.

Accuracy: ± 0.5 minute in the standard unit. Other accuracies available on request.

Operating: 115 volts, single phase, 400 cycles, 25 MA max.

Size: 10 1/2" x 10 1/2" x 10 1/2".

Weight: 15 lbs. complete data.

Kearfott

A  
GENERAL  
PRECISION  
CORPORATION

KEARFOTT COMPANY, INC., LITTLE FALLS, N.J.  
500 N. 10th St., Little Falls, N.J. 07424  
New York: 212-261-0100, 261-0101, 261-0102, 261-0103, 261-0104, 261-0105, 261-0106, 261-0107, 261-0108, 261-0109, 261-0110, 261-0111, 261-0112, 261-0113, 261-0114, 261-0115, 261-0116, 261-0117, 261-0118, 261-0119, 261-0120, 261-0121, 261-0122, 261-0123, 261-0124, 261-0125, 261-0126, 261-0127, 261-0128, 261-0129, 261-0130, 261-0131, 261-0132, 261-0133, 261-0134, 261-0135, 261-0136, 261-0137, 261-0138, 261-0139, 261-0140, 261-0141, 261-0142, 261-0143, 261-0144, 261-0145, 261-0146, 261-0147, 261-0148, 261-0149, 261-0150, 261-0151, 261-0152, 261-0153, 261-0154, 261-0155, 261-0156, 261-0157, 261-0158, 261-0159, 261-0160, 261-0161, 261-0162, 261-0163, 261-0164, 261-0165, 261-0166, 261-0167, 261-0168, 261-0169, 261-0170, 261-0171, 261-0172, 261-0173, 261-0174, 261-0175, 261-0176, 261-0177, 261-0178, 261-0179, 261-0180, 261-0181, 261-0182, 261-0183, 261-0184, 261-0185, 261-0186, 261-0187, 261-0188, 261-0189, 261-0190, 261-0191, 261-0192, 261-0193, 261-0194, 261-0195, 261-0196, 261-0197, 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# first TRUE MINIATURE "E"

## altitude-moisture resistant

Anderson, **Mosel** connectors are the first true miniature "E" types—the only miniature able to pass the new, exacting altitude-moisture resistance test. In this test model, wired connectors are immersed in salt water and altitude cycled to 80,000 ft. for one minute, 65,000 ft. for one-half hour and then returned to ground pressure for another half-hour. **Mosel** insulation resistance after this test is a minimum 1000 megohms.

In aircraft, an insulator and an exacting ground and sea applications anywhere. **Mosel** connectors will provide outstanding service. Any company working with environmentally-resistant connectors is invited to write for complete **Mosel** information.

Standard and precision, stainless steel, silver-plated brass and gold, and plated and unplated variants are other **Mosel** features.

**AMPHENUT** CONNECTOR DIVISION

Amphenut-Burg Electronics Corporation CHICAGO 90, ILLINOIS



stainless steel with a center pile of high drawing copper alloy. The base is an used in a stainless steel head wrap. Sizes from 1 to 14 in have been experimentally produced and run up to 7 is diameter are planned. The fine takes standard end fittings which can be attached mechanically or be welded on during or soldering.

Electronic Corp., Maywood, Ill.



## Miniature Nut

Miniature electrical, selflocking nut is designed for heavier applications in electronic systems of modules and air craft.

Dimensions of the Karlock B14-02 nut are: height .067 in., bore diameter .172 in., width .165 in., 1/32 in. in weight .02 pounds per hundred.

Karlock Mfg. Co., Box 2001, Tualatin, Oregon, Los Angeles 54, Calif.

## Liquid Hydrogen Valve

Stainless steel valve, which rated valve, designed for cryogenic fluids, now is an operating at liquid hydrogen production facilities.

The valve operates in pressure range from 10 to 14,900 psi. It is described as "bubble tight," tight to opening and open over it, and withstands upset and class without freezing.

Specialty Engineering Co., 364 W. Mainview, San Gabriel, Calif.

## BASIC BUILDING BLOCKS FROM KEARFOTT



## FLOATED RATE INTEGRATING GYROS

Specifically designed for missile applications, these Kearfott miniature gyros operate effectively at altitudes. Their outstanding accuracy and performance make them superior to any comparably sized units on the market. Internally sealed within a thermal jacket, these gyros are ruggedly designed and completely adaptable to production methods. Performance characteristics that are more precise can be provided within the same dimensions.

## TYPICAL CHARACTERISTICS

Max. Lifetime  
Along Input Axis 10<sup>5</sup> hr.  
Minimum Lifetime  
Standard deviation about bias  
Angular Position 0.05°/hr.  
Vertical Position 0.05°/hr.  
Bias Rate Due to Inadvertently  
Steady Acceleration  
0.15°/hr. at 10<sup>5</sup> minutes  
Velocity Acceleration  
0.001°/hr. at 10<sup>5</sup> minutes  
Drifting  
Rate of input angle in  
rad/sec. at 10<sup>5</sup> minutes  
Droop Rate  
0.001°/hr. at 10<sup>5</sup> minutes  
Rate Up Time  
10 minutes from -50°F  
Life 1000 hours minimum  
Write for complete data.

Two-Bits Digital



Passive Analog



Four-Bits Integrating



Engineers' knowledge often challenges opportunities in advanced components and system development.

## BASIC BUILDING BLOCKS FROM KEARFOTT



## 20 SECOND SYNCHRO

This synchro, just one of a broad line offered by Kearfott, provides the extreme accuracy required in today's data transmission systems. Kearfott synchros receive cable system designers to achieve unusual accuracy without the need for 3-speed service and elaborate electronics. Typ. proper impedance, matches up to 84 resistor control transformers can also operate from one resolver transmitter.

## TYPICAL CHARACTERISTICS

Size 18  
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## Many Parameters, One Elastomer



### SILASTIC meets varied specs in Convair F-106

When you're calling out materials on a plane or missile, isn't it a help to have one material that can meet a variety of rubber needs? A material that's been proven in all flight regimes? Engineers at Convair San Diego, Div. of General Dynamics Corporation found it so. The material is Silastic, the Dow Corning silicone rubber, and they specify it for many applications aboard the Mach 2-plus F-106 all-weather interceptor.



A completely different application of Silastic is shown at right top: one of many connectors in the air bleed system. All connectors are covered with a flexible hollow of glass reinforced Silastic. The duct beneath carries air at 500 F., and through there is insulation between steel duct and cover, the Silastic must still tolerate high temperatures while retaining its rubberiness and sealing ability.



Among other uses of Silastic aboard the F-106 are these hollow extensions on the air conditioning equipment door. They withstand severe temperatures, maintain a firm seal and after extended lengths of time under compression.



Silastic stays rubbery from -130 to over 500 F., resists aging, weathering, oxidation. Your rubber supply supplier will engineer a part made of Silastic to add reliability to your design. For name of nearest fiber center or more data, write Dept. 0284.

If you remember all the properties of a silicone rubber, you'll specify Silastic.

Look for Silastic

**Dow Corning CORPORATION**

MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CINCINNATI DALLAS LOS ANGELES NEW YORK WASHINGTON D. C.

## AERONAUTICAL ENGINEERING

### Airlines Refine Jet Transport Operations

By Russell Hawkins

**SAN FRANCISCO**—Air carriers aren't out the temptation to use the great load of transport aircraft when turbofan engines become available, and are giving those for specific models, James T. Pyle, deputy administrator of Federal Aviation Agency, told airline operators at the National Turbine-Powered Air Transportation Meeting of the Institute of the Aeronautical Sciences. Pyle said more important research has not been as productive as originally hoped for. Research must continue to be broadened and means must be sought to exact compression above as well as exhaust noiser.

Pyle said increase in maximum length of fuselage (presented) remains from 3,400 ft to 10,500 ft made in preparation for the current generation of jet transports and the final extension, he said, no federal aid will ever be given to contractors for construction of runway longer than this. Pyle called the final limitation a necessity because of the rapid increase in airport real estate and recent construction costs which must eventually be passed on to the passenger. This extra burden is a concern to the best interests of the industry and the nation, he said.

#### Carry Aircraft Loads

Pyle said FAA is pressing to recommend legislation under which the government would guarantee loans for the purchase of "aircraft cargo aircraft." FAA is also trying to limit increasing quantities of military traffic to certified air carriers which are approved for military cargo flights. "We believe these measures will stimulate airlines to greatly expand its cargo capacity," he said.

Pyle noted the competitive threat of the Soviet Union's Aeroflot, largest air carrier in the world. While Aeroflot's present fleet contains about 90% jetliners and about 10% jet aircraft, its goal is to deliver a 95% turbine-powered fleet within five years. The Soviet aircraft will be linked to a new civil sales drive for more domestic service and international service. Pyle said.

"Necessity for a stand which will not hamper the Communist drive. The Soviet civil air company will be one of pricing, payables and recovering the cost. The order of the day will be reduced." To compete, American airlines must not only improve the product, but must find a better sales ap-



**MAJOR COMPONENTS** of General Electric CJ615-23 all for turbojet engines are shown by Neil Riegner (center), manager of General Electric's Commercial Engine Operation, in Walter Reuther (right), General president, United Brotherhood of Carpenters and Joiners of America.

proach, better financing procedures and better customer service, he said.

Discussing the vital importance of ground support to jet airline operations, W. C. Meister, United Jet Lines vice president-engineering, said United has installed 160 million in ground equipment for its fleet of 40 Douglas DC-8s. This amounts to \$170,000 per airplane but once then equipped a line can handle more than additional jet aircraft without much further investment in ground equipment at airports leaving the cost per aircraft down. United's ground equipment for its DC-8 fleet includes 25 million at \$50,000 each, 11 turbo-compressor starters at \$25,000 each, and some "pushers" for servicing the tail section for \$47,000 each.

A total of some 50 types of ground equipment had to be purchased.

#### Baggage Handling

Improvement of baggage handling is one of the important contributions to come along with the jet airlines. United put \$100,000 per aircraft into its baggage handling system. This figure does not include the cost of the previous baggage handlers and the carrying equipment. It was necessary to buy 500 loaders at \$100 each and 750 wagons at \$250 each. Meister said it will take

eight or nine years to amortize these expenditures but, despite the rapid aircraft replacement, the investment will round the price. It has produced a startling improvement in baggage service.

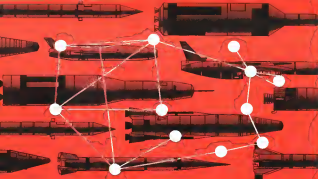
Meister said a need for more, and better, check-in and baggage-loading equipment. He said service and reliability aircraft technology, should you sit in a plane, born for the development of new equipment.

#### DC-8 Performance

Meister and DC-8 performance problems are for less severe, than were reported. In line with frequent flight, he pointed, the DC-8 was developed larger than optimum for engine, engine fully accepting that it would be required to reduce its full growth potential. Efficiency of the aircraft is expected to be such that it will be able to compete on engine developments for many years.

W. F. Rhodes, United manager of flight engineering, made a brief comparison of United and Trans World Airlines operations between San Francisco and New York. He said that of the subset of DC-8 service, United flies optimum altitude and required 12 minutes to make the estimated flight time. TWA's Boeing 707 United is now





**SYNISTANAI** to place together," Hallamore has joined together outstanding engineering talents and facilities to provide complex ground support systems for major aircraft, missile, and space projects. Current contracts include special factory test consoles for the Discoverer; pop-up range instrumentation for the Polaris; static firing instrumentation for the Titan; production of field and factory automatic test equipment for the Sergeant; automatic checkout for Atlas sub-systems; range safety "sky-screen" TV for AFMTC; drone-borne TV display and checkout system for U.S. Army Signal Corps. The Hallamore "Synistanai" capability is available to handle your ground support requirements. Write Hallamore Electronics Company, 714 N. Brookhurst St., Anaheim, California, TWX: AHS279... a division of The Siegel Corporation.

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flying constant altitude and has cut the difference to seven minutes. Rhodes and United has been carrying a 17,400 lb fuel reserve, while TWA has been carrying a 13,000 lb reserve.

Capt. J. B. LeClare of TWA dispute operations research and development challenged Rhodes' statistics. While having no comparable figures, LeClare said statistics for scheduled flights would show a bigger advantage for TWA than the unpublished figures collected by Rhodes. He said United is operating at a higher fuel-to-ton economic power level than TWA 707's. TWA will make its advantage over the DC-8 after the first major overhaul, he said. At that time, TWA will retrofit the same later model Pratt & Whitney JT3 used in the DC-8. LeClare criticized Rhodes for violating a confidence. He said Rhodes' figures were based on information previously exchanged by the two airlines.

#### Necessary Conservation

LeClare said TWA is finding the 707 is over airplane to fly, but a slight problem in dispatching because of the conservation measures in operating a new high-performance airplane. Until recently, for TWA pilots had logged 100 hr. in type. Therefore, they have been required to use minimum time mean of 100 hr and 1 mo. compared with the 400 hr and one mile allowed to pilots with over 100 hr. in type. This has meant more cancellations and delays than would ordinarily occur.

During the current last winter of jet operation, TWA will continue to fly conservative when reserve conditions are marginal. Inevitably, this will affect schedule performance. TWA like other airlines has extremely padded operating margins for the sake of safety. This will close some fields to reserve operations which are legally open. For check on the reserve up to 4 in. thick, permeable gas weight will be cut to 3%. No inlets will be permitted with dash over 4 in. thick. Runways closed by LeClare where runway length and other factors are not to cause problems at Kansas City, Minneapolis, ILS carriers at St. Louis and Denver 16, back course at Pittsburgh.

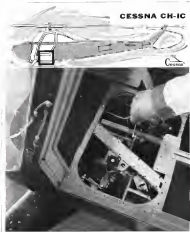
Vertical air traffic control problems which TWA anticipated have not yet surfaced. It was thought probable that some airlines would be needed to control orderly departure from the strip to avoid lengthy holds at the runway before takeoff. High altitude holding pattern and approach distances from the high pattern through a rapid descent procedure to the outer marker were also thought necessary. However, approach procedures have followed about the same strategy and low altitude holding pattern that are used with piston aircraft, though descents from

crossing altitude are more rapid. Departures from the strip are also done occasionally, but New York departures present a problem.

LeClare said "We carry 30% more fuel for time and ground hold at 400 mph than at other airports. We will think some better action must be devised to handle this problem. Our average ground time at LAX is about 15 min. but we have experienced delays of 45 to 60 min." LeClare said revised traffic control patterns in the Chicago area for their extensive use of radar centering to expedite approach and departure of jet flights.

LeClare said "One problem which

concerns us is the fact of positive separation from piston aircraft on the radio-controlled jet system. Our understanding is that the present system depends on frequency separation in the piston aircraft, but this operation is not required to be confirmed by the controller in the area involved. Thus a piston pilot could take off, clear, his transmitter operation with his lower base and subsequently lose it without his knowledge, and proceed across a jet stream VFR without benefit of radar following. A number of piston aircraft in flight in such circumstances to the radio controller substantiates this concern."



#### STABILITY PROBLEM—SOLVED BY CESSNA

Problem: How to achieve, in a helicopter, *Acceptable stability in low speed control*. Solution: The all-environmental stabilization system of Cessna's new multi-purpose CH-40. Eliminating the complex and inaccurate inherent in traditional electronic stabilization systems, the CH-40 delivers stability with economy of maintenance and dependability never before known in helicopter flight.

Maximum stability is used when the rotor hub is in an aerodynamically resistant position with the rotor hub in the "Problem-During" position to meet all such emergency landing in a full stop.

**Military Division**

**CESSNA**







# CANADAIR'S ALL- NEW, ALL- CARGO "FORTY FOUR" SOARS SKYWARD

**FIRST IN FLIGHT, FIRST IN PRODUCTION, FIRST FOR DELIVERY—  
THAT'S THE SUCCESS STORY OF CANADAIR'S NEW CARGOPLANE**

THERE ARE NO IF'S, ANDS OR BUTS ABOUT THIS CARGOPLANE! It is here. It is built for use now. Its first flight marked a giant step forward in its development program. The next step will be its FAA type certification, and then the all-new Canadair Forty Four will go into regular air cargo service with The Flying Tiger Line, Seaboard & Western Airlines and the Royal Canadian Air Force.

THE RIGHT SIZE AT THE RIGHT TIME. The present payload capacity of the "Forty Four" is ideally matched to the forecasted cargo requirements of the 1960's. It is in the '60's that the development rate of air freight will climb sharply toward the major breakthrough in air cargo traffic. The Canadair Forty Four is the right size for highly profitable operations during this rising development period.

**CANADAIR**  
LIMITED MONTREAL, CANADIAN TERRITORY OF



Canadair Forty Four photographed in flight November 10, 1960

**GENERAL DYNAMICS CORPORATION**





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## British Accident Investigation Reports

Burns escapes properly loaded and secured on deck. There was little wind but conditions were foggy up to about 1,800 ft, at which height would expect flight to cease. There is no concrete evidence as to who occupied the pilot's seat on the post-accident, but it is more likely due to the density of the fog that the pilot was Capt. Burns, with Alvin as the co-pilot, not the flight engineer. I accept the evidence of Mr. Seale who saw Captain Seale at the threshold of instructions and at about 10:00 he reached a point some 10 m south-east of Dunsfold. At this point Capt. Meyer informed London Airways that he had engine trouble and wished to return to Blackbushe and asked for the weather there. It is only to be expected that he would return to Dunsfold as he was not clear of the fog. At 10:20 he was 2,000 ft, adding no comment to the operator whether he was able to maintain altitude, but he was able to do so.

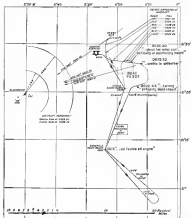
At 5:01 p.m. was asked whether he had forewarned his engine, to which he replied that he had only forewarned it down. Some afterwards, said that he could descend to 1,000 ft. confirmed that he was proceeding to do so. He was then asked whether the flight instructor had indicated that flight instructor had indicated that there was a problem with the engine, to which he replied that he was not aware of any problem with the engine.

It is to be observed that the above messages from the aircraft and Capt. Mayes's wishes to question indicate no sort of

[Following is a report to H. A. Williams, Minister of Transport and Civil Aviation, on a public inquiry, conducted by H. J. Phillips, into the crash of an independent Air Travel, Ltd., Viking transport Sept. 2, 1958, south of London Airport. Three crew members and four passengers on the ground were killed.]

Joseph E. Kahn, a Viking aircraft owner and operator of Independent Air Travel, Ltd. (hereinafter called the company), took off from London Airport at 0514 GMT on Tuesday, Sept. 2, 1938, with a crew of three; for a flight to Naxos and thence via Rhodes to Athens, and from there to Larnaca, August at Tel Aviv on board AT 0612.

rather less than \$1 million—before the storm rushed into houses at Ketchikan Gardens South Hall, about three miles northwest of Lousie Airport, causing considerable damage to property, the deaths of all her crew and of four members of the family.



**CHART** shows Yulian's flight path after taking leave from London. Agents, however, with

[illegible]

John Eke took off from Runway 30R at London Airport at 0104 hr. The crew consisted of Capt. Mungro, No. 1; Brown as first officer and Mr. Howard as engineer officer. The load consisted of two British

\*Throughout this report times quoted in relation to any flight are quoted as reference to Greenwich Mean Time (GMT). Unless otherwise stated times referred to in the narrative of events on the ground are taken direct from the evidence of the witnesses and are accordingly British Summer Time (BST).



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## Lockheed Missiles and Space Division

invites your inquiry into these

# UNUSUAL RESEARCH AND DEVELOPMENT OPPORTUNITIES

Important career positions are available at Lockheed Missiles and Space Division at its new facilities on the beautiful San Francisco Peninsula—one of the choicest living areas in the nation. Headquarters for the Division are at Sunnyvale, California, with Research and Development Facilities located in the Stanford Industrial Park in nearby Palo Alto.

The Division is widely diversified—having complete capability in more than 40 areas of science and technology, from concept to operation. Areas of work include: metallurgy; sonar; reconnaissance; computer design and development; propulsion and exotic fuels; space physics; hydrodynamics; the flight sciences; space medicine; manned space vehicles; telemetry; electronics; applied mathematics; operations research and analysis; space communications; telemetry, design; and test, both environmental and flight.

Equipment and facilities are completely modern and include one of the largest computer centers in the world.

The Division is systems manager for several major long-range projects and its research and development programs reach far into the future. It is a rewarding future with a company that has an outstanding record of leadership and progress.

Unusual opportunities exist for experienced engineers and scientists to contribute to the solution of new problems in the areas listed on the next page. If you are experienced in these areas, or have background in related fields, we invite your inquiry. Please write: Research and Development Staff, Dept. L-17, 562 West El Camino Real, Sunnyvale, California. U.S. citizenship required.

### AEROSPACE FLIGHT DYNAMICS AND PERFORMANCE

Advanced degree preferred with background in one or more of the following areas: flight test analysis of canopy egress systems and/or systems evaluation; flight test analysis of interceptors and jet engines; evaluation theory of subsonic and hypersonic aerodynamics; underwater stability and control hydrodynamics; aerodynamic preliminary design studies; research in gas dynamics studies of thrust vector control, stage separation, propulsion systems analysis, and rocket nozzle design, or wind tunnel studies and testing.

#### ANALYTICAL MECHANICS

Advanced degree required with real time experience with analog computers. For the solution of problems in flight controls, guidance, and other dynamic systems analysis and process controls.

#### ANTENNA DESIGN

Advanced degree in E.E. preferred with background of several years' experience in antenna design for space vehicles.

#### CRYSTALLINE

Ph.D. preferred, advanced degree required, with strong research background for development work in fuel cells, batteries, the direct conversion of electrochemical energy, electrode kinetics, catalysis, photochemistry, thin film, and solid state. Work concerns both military and commercial applications.

Advanced degree required, Ph.D. preferred with background in either physical organic chemistry, inorganic chemistry, analytical chemistry, or electrochemistry for research and development work in such areas as: macromolecular analytical techniques including infrared, ultraviolet and mass spectroscopy; gas solid reactions; kinetics; microchemical analysis techniques; surface treatment of metals and various ceramic kinetics; polymerization of substances in vacuum environments including formulation of elastomers; or condensed plasmas.

#### OPTICS

Advanced degree in E.E. or physics preferred but not required, with experience in infrared systems research and development, or electronic cameras with background in electronic information theory, synchronization, specialized circuitry, as in low-level lighting arrays, or phenomena with background in optics or semi-conductors. For work in infrared physics research, advanced system development, or physical measurements in infrared.

#### PHYSIOLOGICAL RESEARCH

Degree in E.E. or communications with background in design of UHF, VHF and RF transmission, telemetry systems and components, circuit design or logical design components.

### GENERAL DESIGN

Background of graduate work in E.E. or math, with interest in advanced areas of computer research in such efforts as: pattern recognition, automatic studies, logical design and switching theory, information retrieval, and behavior patterns of artificial sensors patterned closely after those of the human brain.

### MECHANICAL DESIGN

Advanced degree in M.E. preferred with background of mathematics and small structures desirable. For research in experimental design and the development of a variety of research test models.

Advanced degree in M.E. preferred with experience in the design of aero and thermodynamic engine scale models including previous work in wind tunnel model design and test. Shop based experience desirable.

### STRUCTURAL

Advanced degree preferred for basic and applied research in one or more of the following areas: metal fatigue behavior and mechanisms concerning high temperature and advanced missile materials with interest in metal physics, deformation and fracture, phase equilibria, transformations, or diffusion. Also, to conduct basic and applied studies in electrolytic metals, dispersed phase systems, fiber metallurgy, stresses and thermal sensitive materials systems. Also, the X-ray and electron diffraction research and studies in single crystals, point defects, parameter measurements, pole figure distributions.

### TECHNOLOGY

Experience required in MASER amplifiers and suitable microwave parametric devices, for experimental research in microwave.

### TELEVISION

Degree in E.E. required and several years' experience in developmental testing of ordinance and pyrotechnic devices, preferably in the missile field, with complete familiarity with high speed cinematography, an oscilloscope, pulse circuitry techniques, high speed photography, and instrumentation methods for recording pressure shock; velocity and temperature for the development of ordinance equipment for missiles.

### USE IN A FIELD OFFICE

Advanced degree required and Ph.D. preferred in E.E., physics or chemistry and evidence of creative, original work through published articles, patents or superior Ph.D. thesis for research work in one or more of the following: thermodynamic, photoelectric, luminescent, ferroic, logic component, sensor, thermistor, or cryogenic devices. Also, material analysis and evaluation, processing techniques design and development of novel electronic devices and components, circuit analysis, circuit topology, or micro-miniaturization.

# Lockheed

## MISSILES AND SPACE DIVISION

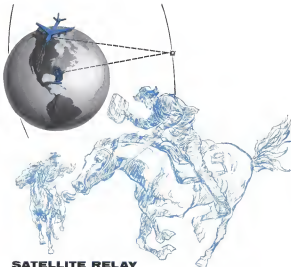
Systems Manager for Navy POLARIS FBM; DISCOVERER, MIDAS and SAMOS;  
Army KINGFISHER; Air Force Q-3 and X-7

SUNNYVALE PALO ALTO VAN NUYS SANTA CRUZ SANTA BARBARA CALIF. CAPE CANAVERAL FLA. HAWAII HONOLULU IL. IN. JERSEY









## SATELLITE RELAY

... for modern long-range communications

Peep Express riders begin an American tradition for the reliable relay of important messages over long distances. Today, Bendix is proud of its role in extending this tradition to SAC communications through the active relay satellite program.

Under Project STEER, Bendix has prime responsibility for the entire communication system. STEER will use polar orbit satellites to relay messages and pilot messages between Air Force ground stations in the United States and SAC bombers ranging on global missions. The ideal vantage point of a satellite relay will permit utilization of line-of-sight advanced UHF techniques. The fading and interference problems inherent in the

ionospheric transmissions of present HIF long-range communications will be avoided.

Other space age projects at the Bendix Systems Division include magnetron technology, highly reliable radiation-resistant communications equipment, interpretation and prediction of infrared reconnaissance, new satellite stabilization techniques, and communication methods to penetrate the ionized shock layer surrounding hypersonic vehicles. Additional projects involve satellites for weather and ground infrared reconnaissance, and for radio navigation.

Opportunities are open to better engineers and scientists interested in participating in advanced space programs in an ideal scientific climate.

**Bendix Systems Division**

ANN ARBOR, MICHIGAN



Bendix Hercules B34 engines driving Royal Free bladed all-weather propellers. It was used routinely by the Royal Air Force and by the Ministry of Supply, chiefly on TC aircraft and experimental flying tests until 1957 when it was placed in storage, having flown a total of only 1,812 hr.

Jetel B34 was produced in September 1957 by the company, which obtained a Certificate of Registration in 1958 and thereafter operated the aircraft which had flown a total of only 2,599 hr at the time of the accident.

The Certificate of Registration was re-issued on May 6, 1958, and ran valid until May 5, 1959, and consequently at the time of the accident B34's current status of the certificate would have been 753 hr.

At the time of the accident, each engine ran well within its approved life: the port engine had flown 1,693 out of the permitted 3,270 hr since overhaul in January 1956 and the starboard engine 964 hr more it was overhauled on May 1956.

The propellers have also within their approved running life of 1,248 hr since overhaul, the port propeller having run 1,155 hr since February, 1954 and the starboard 1,016 hr since November, 1954. They had, however, been in use in excess of their regulated endurance like all three runs from the overhaul that dates being 15 months in the case of the port and four months in the case of the starboard propeller. In failing to observe the requirement as to overhaul life the company has acted with negligence with the license of the Air Registration Board. In the light of the contents of the propeller as detailed by their manufacturers after the crash it is quite clear that this error had no adverse effect on the accident and that the condition of the propellers was such that if an inspection had been made they were in compliance with the rule that life should not have exceeded.

### Feathering Impossible

Despite the warnings of the cockpit and the fact which followed the crash the contents of the letters of the Air Registration Board, together with the fact of representations of the British Aircraft Co. and of Jetel Propellers Ltd., proved that the engine was in normal working order when the propellers, and that the starboard engine showed no signs of lack of lubrication. The engine was slow that there was no mechanical failure of the propeller in either position. Finally, however it was established that the starboard feathering motor was broken out and that this had occurred prior to the crash in fact which explains the inability of Capt. Minter to feather this engine. The destruction of the wing was so complete that it was impossible to maintain the aircraft in one full lift.

Since the air of the intensity of the company's activities and the air of the accident is perhaps important in illustrating the need for a first class maintenance organization.

On January, Aug. 26, 1958, Jetel B34 left Blackbushe at 1510 hr for London Airport, Leam and thence to New where it arrived at 2200 hr GMT.

On Wednesday, Aug. 27, it left New at 0815 hr for Ayton to Kees and thence to

**SINCE 1954...  
PROVED IN USE**

**---CAE TC-106  
(USAF TYPE MA-1A)**

**PORTABLE  
STARTING UNIT  
FOR  
LARGE JET AIRCRAFT**



**MODEL 141  
TURBO-COMPRESSOR  
ENGINE**

■ This fine profile of Continental development and engineering with the CAE Model 141 turbo-compressor as its heart, has a fine record of exceptional performance to date.

... More than 1,000 MA-1A's and their preferred MA-1's have been delivered to the Air Force since 1954. These actual experience have led to several removal of hours between overhaul schedules with an overall power well in excess of 2,300 shaft indicated as likely 1550 type units as can be seen from overall manufacturers' and independent test data requirements as to input in overall, have exceeded 2,400 shaft and are an excellent example of condition as change of major parts having been made. Official Air Force records show the work and in combination with 10-15 per cent service availability, and almost complete freedom from field down time for maintenance or modifications—all in addition to the important factor of low initial price. ... More it comes in USAF-PROVED ground support equipment, CAE is first choice.

★ ★ ★

CAE gas turbine units—the famous J44's—are in General's T-34 jet trainer. Figure 411 F4U fighter, Mustang, F-86 Sabre jet fighters, and many others. From the J44 have evolved the J44-1, J44-2, J44-3, J44-4, J44-5, J44-6, J44-7, J44-8, J44-9, J44-10, J44-11, J44-12, J44-13, J44-14, J44-15, J44-16, J44-17, J44-18, J44-19, J44-20, J44-21, J44-22, J44-23, J44-24, J44-25, J44-26, J44-27, J44-28, J44-29, J44-30, J44-31, J44-32, J44-33, J44-34, J44-35, J44-36, J44-37, J44-38, J44-39, J44-40, J44-41, J44-42, J44-43, J44-44, J44-45, J44-46, J44-47, J44-48, J44-49, J44-50, J44-51, J44-52, J44-53, J44-54, J44-55, J44-56, J44-57, J44-58, J44-59, J44-60, J44-61, J44-62, J44-63, J44-64, J44-65, J44-66, J44-67, J44-68, J44-69, J44-70, J44-71, J44-72, J44-73, J44-74, J44-75, J44-76, J44-77, J44-78, J44-79, J44-80, J44-81, J44-82, J44-83, J44-84, J44-85, J44-86, J44-87, J44-88, J44-89, J44-90, J44-91, J44-92, J44-93, J44-94, J44-95, J44-96, J44-97, J44-98, J44-99, J44-100, J44-101, J44-102, J44-103, J44-104, J44-105, J44-106, J44-107, J44-108, J44-109, J44-110, J44-111, J44-112, J44-113, J44-114, J44-115, J44-116, J44-117, J44-118, J44-119, 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Altoona and from there to Los Angeles, Feb. 15, arriving at 11:15 PM.

On Thursday, Aug. 25, the aircraft left Los Angeles and flew to Mexico in Cyprus, thence to Altoona, arriving at 2:45 PM.

On Friday, Aug. 26, Capt. Munger and three took off from Los Angeles at 07:00 for Los Angeles thence to Nice and then, thence to London, England, where it landed at 19:00 hr.

On Saturday, Aug. 30, Capt. Munger and three took off from London, England at 11:15, landing after 10 hours single-engine flight. Three hours later Capt. Munger, with a different crew, took off and flew to Los Angeles, thence to Nice and then back to Blacksville, landing at 22:30 hr on the morning of Sunday, Aug. 31.

At 07:15 hr that morning, Munger flew and a quarter hour later, Capt. Ebra took off again, piloted by Capt. Kowalski. He flew to Gander, thence to London and then to London, landing at Blacksville, landing at 22:30 hr on the morning of Monday, Sept. 1, 1974.

Thus, in six days, the aircraft had been actually in the air for 94 hr 45 min.

### Modifications Noted

On the morning of Monday, Sept. 1, Capt. Kowalski notified those on the ground of such modifications noted—mod. engine CSU, air lock also missing, suggest change CSU for fuel.

The CSU is an abbreviation for the "constant speed unit," a flywheel-driven unit fitted on top of the engine drive in the propeller and which serves to maintain the revolutions of the propeller at a constant speed.

The inspection of the company personnel for the purpose at Blacksville at one time of other crew or two men found that maintenance work on engine, together with a number of unexplained items. Likewise, there were one or more men located in the maintenance of the antenna and two men of whom only one was licensed, to maintain radio equipment.

The aircraft was due to leave Blacksville about 06:00 hr on Monday in order to be in Los Angeles, England, to land the first engine if being installed that it should have that covering for New York in case it was in Los Angeles. Accordingly, the crew left for maintenance was strictly on time.

The company's engineering department did not at this date, present an approved inspection report and accordingly no work of repair or maintenance required or indicated in a licensed engine, whether it was checked, engine, antenna or radio. The steps required required available on Monday, Sept. 1, note Captain Munger's (Hank) (Hank) and (Hank) (Hank) is in contact to deal with each component in turn.

### Repairs Made

As soon as the aircraft was available in the next hours of the morning two flight members of whom one called in a certain number, who were in order. Captain Munger began to carry out a Check 1 on the airframe engine—the map being left for the technician in daylight. The Check 1 was the scheduled engine work first completed by

07:30 hr when two fresh faces, (Hank) and (Hank) reported for duty. One of them carried out a Check 1 on the port engine while the other proceeded to deal with the map.

The latter fitted a new shaft seal to the standard propeller and removed the CSU, replacing it with another taken from stock, together with a new engine drive bearing at the base of the CSU which it connects with the engine.

A CSU can itself be taken apart, the two sections being sealed by a thin rubber band of circular shape fitted into a slot cut in the engine case. Captain stated in evidence and I accept that he had never seen a CSU taken apart so in replacing the rubber band on seal while the company's approved maintenance schedule rightly stipulated that if a CSU was taken to pieces to be to replace the seal and that he notified to the engine until it had been re-assembled on a bench. The CSU fitted on this occasion and taken from stock had been thoroughly inspected and tested.

This work to the engine completed, they were given a ground run by Captain, who in the course of this ground run carried out a full working test on each engine. To carry out the test involved firstly raising a lever and secondly pressing in a button situated in the other above the head of the pilot, so bringing into play a small electrical switch. This button being depressed for some 10 sec would allow the motor to build up the propeller, whereupon the fuel should be released and if it were failed to cause it to spring out on release should be pulled out. If allowed to remain depressed the motor would continue to run and would, if left in for over seven minutes, burn itself out, with the result that it would no longer be available, if it was closed to submerge the shaft for which required the button to be depressed was again.

The work on the engine detailed above was in due course completed by Captain, who in addition aligned the propeller and examined their contents at 2:40 pm. It was checked to submerge the shaft of which he found no cracks between 31 and 32 g.

### Work Supervision

In considering the actions and steps, some of these work are several hours to be done in mind. Much of it and in particular the Check 1 on the standard engine, was carried out in an unlicensed manner between 7 and 7 am. I doubt whether Captain could have effectively supervised this work. On the other hand, work on the airframe, seal and fitting a new CSU and gasket was performed in daylight by a man who knew both his work and the efficiency of work on the standard work and was not supervised by subsequent events.

In carrying out a complete fullworking test on each engine Captain was in contact from the time of the removal of the approved maintenance schedule of the company, which prescribed a work check once in a Check 3. This requirement was proper, as it is a full working test on the engine, which conducted might lead to the failure of the engine. Captain explained that he had never seen the approved maintenance schedule—reference which he referred

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If you'd like to know more about this work, read: "Titanium for Aircraft and

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World's record of 166.5 mph over a 100-lm. wingspan closed course was set by the Mi-6 twin jet helicopter (AW Nov. 10, p. 28) carrying a four-man team, according to Soviet officials. Previous record of 141.5 mph. was set by a custom-powered Sikorski HO4.

On a broad view of the evidence it is quite clear to me that the policy of the company was to keep its aircraft flying at all costs and without any real regard for the requirements of passengers, and that its aircraft was, in fact, at least to have at one time been there. If any record of the way done in London airport was

The last sheet taped to Capt Wagner before leaving London airport purported to show that the weight of a stack was 12 kg rather than the purported maximum. In fact, it was stated that the aircraft was over loaded to the amount of nearly 400 kg (880 lb). A great deal of nuclear war is directed on this subject but it is not, I think, necessary to detail it. Briefly, what was done was to take an 114-pg of paper at London airport, thus providing at least 512-pg and probably more of false and to come to

At this time it is not to be supposed that the overload can have been a serious factor in causing the crash. The attitude of properly handled, ought still to have been able to stand on one's legs, and the only significance to be attributed to the overload is that it certainly cannot have reduced Capt. Merges's capacity and effectiveness to the final crash.

Capt Vlugter was a pilot of great experience. He had flown some 15,000 hours in B-24's and the B-47. Following discharge from the B-24 he had worked for Dow Air for six months and then entered the employment of the company in May, 1956. He was listed by Capt Wood the chief pilot of the company, on Apr. 11 and again on Aug. 20, 1957. From May 1957

On Sunday, Aug. 10 he left with three or four other boys leaving London by boat at 11:57 p.m. and landing at Blackheath after a flight of 10 mi. At 12:05 he left Blackheath with a different crew and flew to Farn. Nine and half to Blackheath arriving at 12:30 by air Aug. 11. After spending the remainder of the night with friends near Blackheath he took off at 2000 by air on the morning of Sunday, Aug. 11 in a DC-4 and flew to Barcelona, returning to Blackheath at 1925 in that evening. When he arrived in the Westland crew he was awarded to the Westland crew. He remained in Spain the night with his wife and child. Mrs. Minger stated that he and "J" he claims that night.

On Sept. 7 he reported his clerk, at Washburn and Rye, to London Airport, leaving Hutton on the way and thereafter swimming on the airport, until at least 2000 hr, and possibly later, when he went to the Berlitz Annex Hotel for the night. According to the evidence put before me, he had no food that evening and only a small whiskey and soda before going to bed. He was aroused about 0100 hr in the morning







These weather items prepared in consultation with the United States Weather Bureau



## Some observations on a major weather problem in aviation

**Layer-type clouds**—Long conditions may extend over broad areas in the cloud formation creating conditions you build up when the cloud layer.

**Conviform and cumulus clouds**—As contrasted to layer-type clouds, wing in conviform clouds may be found in considerably higher altitudes. In the tops of cumulus clouds, even with temperatures above freezing, clear ice may be formed at a dangerously rapid rate. This is especially true in such clouds formed over or near large bodies of water.

**Temperatures**—Hardest wing severity occurs in 15°F to 22°F range. Therefore, wings should be kept for ice formation on aircraft when flying in clouds or precipitation if outside air temperatures is in or near this range.

Remember, even in clear weather *subzero* wing may occur when temperatures are between 22°F and 30°F and humidity is high. Temperature of air passing through carburetor may drop in attack to 60°F, causing frost to form and restricting flow of fuel to engine.



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been entrusted to check Altus on the flight from London Airport, not do I believe the evidence of Capt. Lloyd or Capt. Bright that he said he had done so and found him satisfactory. The absence of my aids in the log book is contrary to that made in the case of Tullin as significant. It is also curious if their evidence were true, that the time for Altus should have been completed and landed to base at London Airport whereas the time for Altus was based on the wreckage scene stated. I doubt that Capt. Meyer may have said that Altus was a good type, and may have agreed to take him on the flight to New York but later in the course of it. What may or may not have been said both Capt. Lloyd and Capt. Bright know perfectly well that the aircraft had flown from London Airport on its own and was in good condition when the flight ended with 10 men. I am certain indeed that no proper test was carried out, or indeed could have been carried out, in the course of the short flight. It was admitted that the crew may not have been short of fuel personnel and hence also I have no doubt whatever that the requirements of the regulations were being disregarded in the interests of the commercial advantage of the company.

I have already dealt with the position of Altus and, as far as the evidence on the flight after less than three weeks' flight, would by the company—a man who is not prepared to testify as to the capacity of the aircraft and is agreed to whom hardly anyone Capt. Meyer to "keep his finger on his."

## Insufficient Checks

To sum up, I am satisfied that the checks carried out on Capt. Meyer in April and August 1958 were insufficient to test his ability to deal with a very severe winging the wing and landing of the aircraft on one engine. I am equally satisfied that no proper test in the case of Altus in fact as test officer of the aircraft had been carried out before he took part in the test flight on the morning of Sept. 1 and that then, in no manner, it is possible that Altus's experience fitted him to land a member of the crew upon whom the pilot could rely.

There can be no doubt that both Capt. Bright and Capt. Lloyd were fully aware of the fact that no proper check had been carried out to test Altus's abilities. It is I think, a great criticism of Capt. Bright that he should have allowed Altus to go in the aircraft, bearing in mind the criticism to which he had been subjected in an previous report.

The question of fatigue is important. Capt. Meyer had been 72 hours the 17th and Aug. 26 when he was pronounced fit for duty. His doctor who gave evidence stated that there was no reason to suppose that this claim should have affected his following his duties in duty even though his condition had resulted in a high rate performance for a few days.

It is clear, however, that following his return to duty and prior to the final flight he had not been afforded the rest hours required by Article 146 of the Air Navigation Act, 1935 (Amendment) Order, 1957. Under the regulations no pilot is to be required to make a flight or a public transport aircraft unless he has had at least 12



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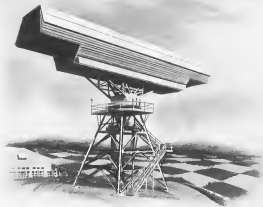












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## Sikorsky H55-2 Conducts ASW Tests

U. S. Navy reconnaissance marine aviators just tests are conducted by a Sikorsky H55-2 over the Atlantic Ocean off Long Island Sound. Some ball is attached into a well in the aircraft's under-hatch parachute under figure "Y" a UHF antenna.

Some, and the collection of such defects.

(5) On the termination of every flight the person in command of the aircraft shall order to the record of defects (1) particulars of any defects in the aircraft including its engine, components, accessories, instruments, equipment, apparatus and their installation observed by him during the flight or reported to him, or (2) if no such defect has been observed by him during the flight, a statement to that effect, and shall sign and date such entry.

(6) When receiving any such defect in the aircraft the person observing such defect shall enter in the record of defects particulars of such defect and shall sign and date such entry.

(7) The operator shall enter in the record of defects in the record of defects for a period of two years after the expiration of the period of validity of such certificate of airworthiness and in no case earlier than the expiration of two years. Otherwise this is defined if instead of an entry being made after each flight a mark, made when the aircraft returns to base or at, although made at each landing, no duplicate is left on the ground so that in the event of a crash all

copies of an entry in such a record are made in the appropriate log book, the operator shall, in case of an emergency, portable, and in any case within six months of the expiration of the period of validity of such certificate of airworthiness, cause particulars sufficient to identify the entry to be written in such log book.

Article 70(16) defines a "flight" as follows: "Flight includes the whole of the period commencing in transit from an aerodrome to the aerodrome of next landing from the time when the aircraft is first in motion on the ground until the time when it comes to rest on landing."

### Records Lost

An incident by the Air Registration Board against the whole object of Article 17(15) is to ensure the making of the appropriate entry after each flight is defined and the preservation of the record of defects for a period of two years. Obviously this is defined if instead of an entry being made after each flight a mark, made when the aircraft returns to base or at, although made at each landing, no duplicate is left on the ground so that in the event of a crash all

records are lost. In this case if any record was made of the work done at London Airport this could not be recovered.

Having referred to the evidence, such as photographs, that of Mr. Norman Elliott, the technical director of the company, I have no doubt that the practice of the company was to send on a flight an engineer who was in most cases not licensed to write any mark of maintenance or certification to the aircraft. The work done by this man was not usually certified if it is only when the aircraft returned to base when a licensed engineer would check with him what had been done and then sign the appropriate certificate.

In the event we should the services of a licensed engineer available locally were made use of on a licensed engineer was flown from the company's base to the airport where the aircraft was grounded, but the actual practice was an aircraft had left base in order to get the responsibility on the pilot to decide whether to get local help or call for maintenance from base with the result that in the extreme case the pilot would call the work and the aircraft then continued its journey.

Flights appeared to get the practice to



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an agreement between the parties to Republic 49 of the 1st November (General) Republic 1914 dropped to avoid the carrying out of a program, again in emergency. The agreement was then as usual but left in force it was in 1914 and around 1914 an agreement on the authority of the parties, he treated as a matter of law, and it was not to be the subject of a program and carried on in 1914. This is suggested that having reached London, Republic 1914, the agreement was "made" and it was quite proper on the authority of the parties for indicated only to be effect again in the "emergency" and for the parties to be in, not to be in and back in 1914.

It is, of course, when an aircraft has carried that the term of delivery of air work of maintenance or maintenance is of most importance. If, 1914, it is to be of all value in such circumstances it is, I think, essential that a duplicate of each copy, each also a light should be left on the ground and that the agreement that the copy shall be made after each flight should not be made under the parties that the agreement remains in emergency. It is perhaps even more important that, if an aircraft has to be agreed by an indicated subject to circumstances which require a true emergency it should not therefore be liable to be taken to the next extent when the work done can be properly in special and carried.

I would therefore recommend:  
(1) That in the case of the aircraft record of flights in emergency maintenance should be made in respect that the record shall be completed in duplicate at the termination of each flight as defined by Article 1914 and that a copy of each copy shall only be carried in the aircraft and that a duplicate shall be made to ensure the preservation of the record for two years.

It was to be noted that the parties in regard to the aircraft shall be in 1914 to the parties. See Article 25 (4) (1) of the 1st November (General) Republic 1914 in 1914.

(2) The parties (1914) as the parties to Republic 1914 should be defined as applying only to circumstances where an aircraft has been carried in 1914 and that the parties or the parties in 1914 should be defined as applying only to circumstances where an aircraft has been carried in 1914 and that the parties in 1914 should be defined as applying only to circumstances where an aircraft has been carried in 1914.

## Radio, Radar Ruling Requested by FAA

Washington—The Federal Aviation Agency has proposed a new ruling, requiring agency approval of all airborne radio and radar equipment installed on aircraft operations as scheduled and top priority aircraft.

The ruling will include such devices as airborne weather and Doppler radar, FAA and that these devices, although not required equipment, may have an effect on flight safety and thus should be subjected to FAA approval.



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## WHO'S WHERE

(Continued from page 23)

### Changes

Lynn G. Holmes, director of engineering operations, Brunswick-Curtis, Division of General Dynamics Corp., Rochester, N. Y. Also: Frederick F. Caudron, assistant general manager, Smeadberg-Carlson San Diego, and Robert A. Fumella, manager of engineering.

Jack Katten, manager-engineering administration and acquisition, General Electric Co., Miami and Santa Vilela, Deputy from Philadelphia, Pa. Also Otto Klina, manager of a division representing operations. Thomas A. McDougall, manager of project development, Lockheed Aircraft International, Los Angeles, Calif.

S. George Lawson, operations manager, Sorensen-Holmes, Division of General Dynamics Corp., Warren, Mich.

Capo E. Bomer, director of administration, operations and Ronald Berman, director of program operations, Stone-Walsh, a division of Thompson-Ramo-Woolf design, Inc., Los Angeles, Calif.

George A. Robson, director of the Test Division, The Martin Co., Denver, Colo., Denver. Also: Raymond E. Gelfin, manager, Basic Systems Department, Engineering Division, Thomas F. Tinner, director of industrial relations.

Edward R. Corry, deputy director of planning, American Machine & Foundry Co., New York, N. Y. Also: J. D. Genn, acting general manager of the company. Alexandria, Va., Division, replacing Mr. Corry.

Joseph L. Decker, manager, Research and development project, Air Arm Division of Westinghouse Electric Corp., Baltimore, Md.

Clarence S. Sorenson, manager of industrial relations, Avco Division, Avco General Corp., Covina, Calif.

John W. Hines, manager of long-range planning, General Gas, Division of General Dynamics Corp., San Diego, Calif.

Stanley Dorn, manufacturing manager, The General Corp., Air General Division, Elms, N. Y.

Joseph Carlsson, chief engineer, King Department, Connecticut, N. Y., of the New York Division of United Aircraft Corp.

Dr. Charles L. Kugler, program manager MJO (airborne long-range missile) USAF contract, Huntington Corp., Detroit, Mich. Also: Melvin M. Spector, Dr. Kugler is a manager of Huntington, Great Valley, Pa., Laboratory.

Jack E. Brinkley, program manager Nike Zeus system, Douglas Aircraft Co., Inc., Santa Monica, Calif. Also: Paul Jones, assistant Zeus program manager.

Anthony Del Dora, chief engineer, Matco Corp., a division of Air Logistics Corp., Princeton, Calif.

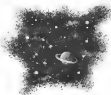
V. M. Bennett, program manager Army projects, Ryan Electronics, a division of Ryan Associates Co., San Diego, Calif. Also: Arthur H. Stanley, chief of engineering services.

Dr. J. R. McClellan, director of electronics research and development, Bradco Research Corp., Burlington, Calif.

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